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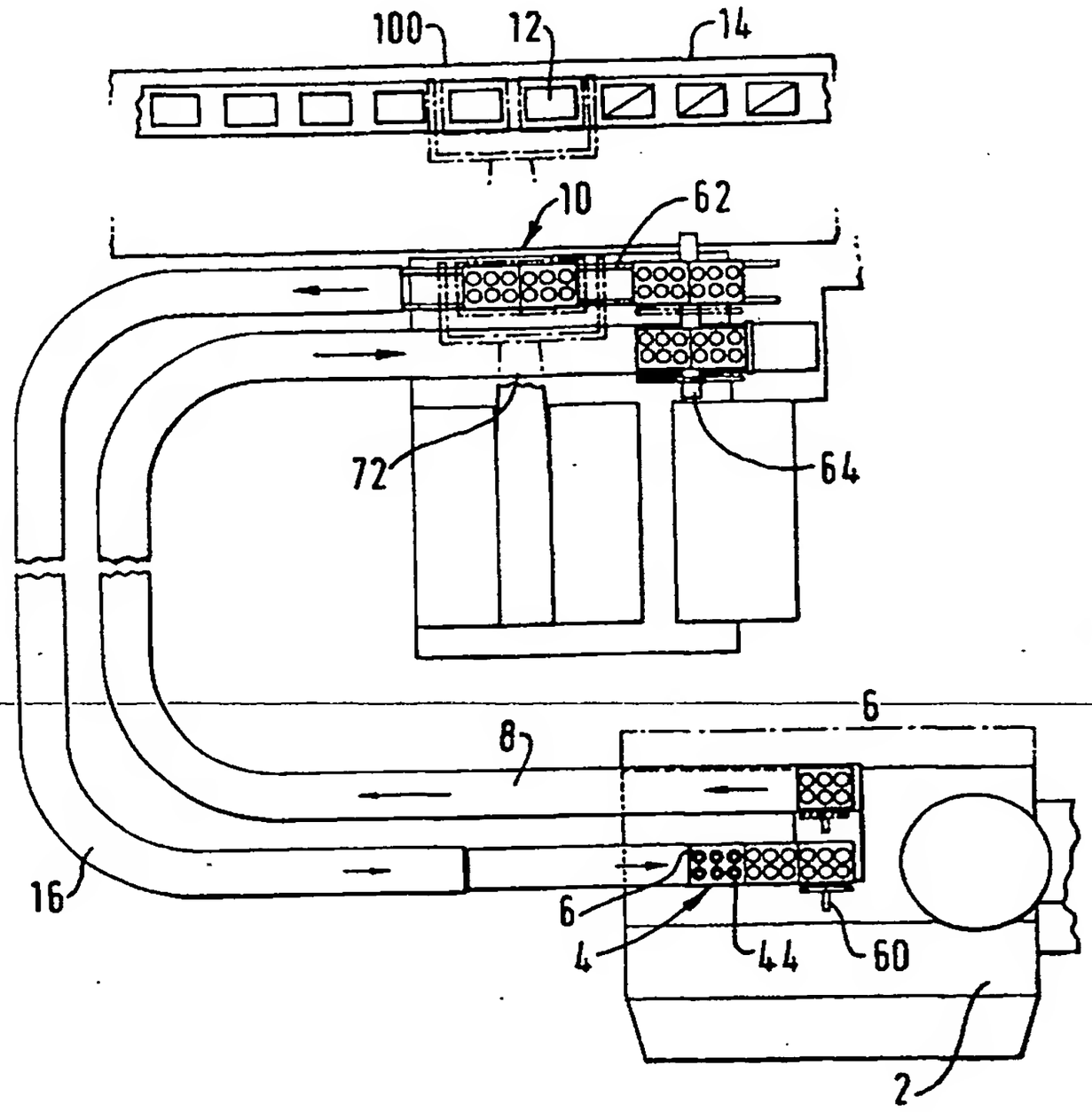
(57) Abstract

Infusion packages are produced in a machine (2) and stacked in carriers (6). The carriers (6) are conveyed to a transfer means (10) where the stacks of packages are transferred into transfer chambers which move the stacks to overlie open mouthed containers (12), into which the packages are deposited.



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A METHOD FOR MANUFACTURING AND PACKING INFUSION PACKAGES AND AN APPARATUS THEREFOR

The present invention relates to a method of, and an apparatus for, manufacturing and packaging infusion packages, such as tea bags, coffee bags and the like.

In a known manufacturing and packaging process, infusion packages are cut from a high speed two-ply web, and stacked in two adjacent vertical columns in a pair of collating tubes arranged generally below the cutting device. The stacks then undergo a sideways step to move them over a carton and are then moved vertically downwardly into the carton. The carton is indexed to advance to receive a second pair of stacks and so on until the carton is filled. This process provides the significant advantage that the packages are neatly and efficiently arranged in stacks in the carton. However, a drawback with the known process is that the package manufacture and its packing are carried out in a very confined space and do not easily allow for flexibility in, for example, the type of container into which the infusion packages are packed or the number of stacks received in each container. Also, because stacks are placed in the cartons in pairs, there can be a tendency for stacks already in a partially filled carton to be disturbed as the carton is indexed to receive subsequent pairs of stacks.

From a first aspect, the invention provides a method of manufacturing infusion packages and for inserting them into packs, comprising the steps of:

sealing doses of infusion beverage between ~~travelling porous webs to form a two ply porous web with~~ infusion containing pockets and cutting said pockets from the web to form infusion packages;

stacking the cut infusion packages in a horizontal orientation to form vertical stacks of packages;

inserting the vertical stacks of packages into a

carrier;

transporting said carrier, after it has received a predetermined number of vertical stacks of packages, to a packing station remote from the stacking location; and

at the packing station, removing a predetermined number of vertical stacks of infusion packages from the carrier and placing said stacks into an open topped container configured closely to surround the stacks of packages.

From a second aspect, the invention provides apparatus for manufacturing infusion packages and for inserting them into packs, comprising:

means for sealing doses of infusion beverage between travelling porous webs to form a two ply porous web with infusion containing pockets;

means for cutting these pockets from the web to form infusion packages;

means for stacking the infusion packages in a horizontal orientation to form vertical stacks of packages;

means for inserting the vertical stacks of packages into a carrier;

means for transporting the carrier, after it has received a predetermined number of vertical stacks of infusion packages, to a packing station remote from the stacking means; and

at the packing station, means for removing a predetermined number of vertical stacks of infusion packages from the carrier and transferring them into an open topped container.

Thus in accordance with the invention, infusion packages are cut from a web and arranged in vertical stacks in a carrier, which is then transported to a location remote from the stacking means, from where predetermined numbers of stacks can be removed and filled into packs. This gives considerably greater flexibility in the overall manufacturing and packing process. The manufacture and packing stages are

effectively decoupled which is an advantageous departure in the context of infusion package manufacture.

The carrier is configured to provide vertically oriented stack receiving passages to receive at least one or two vertical stacks of packages, and preferably more. Preferably the carrier receives two stacks of packages simultaneously. Conveniently the carrier may be indexed to receive successive stacks or rows of stack pairs, say three or four rows per carrier giving a total of six or eight stacks per carrier. Each stack preferably contains a predetermined number of packages.

Preferably successive carriers are filled with stacks of infusion packages, the carriers preferably being independent from one another so that they can be moved independently of one another and can be put on or taken off the machine as desired, for example for storage or replacement. This also gives considerable flexibility in that for example different carriers may be provided for different shapes of infusion packages without the need for major redesigning of the packing process.

In one embodiment, the carrier may comprise a plastic or other block having a number of stack receiving passages, e.g. in the form of bores sized to receive the packages, which will be of a known, predetermined size. Of course the carrier could equally be of a moulded or machined plastic or a metal construction.

The stacks may be formed in stacking means which may comprise one or more collating tubes into which cut packages are pushed. Each tube preferably has one or more retractable fingers extending into the tube, and on top of which the stacks are formed. The fingers move down the tube as the tube fills with packages, are retracted from the tube when it has received a number of packages, and are then moved back up the tube and re-inserted to allow the next stack to form.

The collating tube or tubes are arranged above the

passages in the carrier, so that the packages can drop down into the passages. Preferably, however, means are provided to control the positioning of the stacks within the passages. Means, such as one or more fingers supporting the stack, may enter the passages from above, but preferably a piston or the like is provided which extends up through the bottom of each stack receiving passage to receive the stack once the fingers have been retracted, and move the stack down into the passage in a controlled manner. The carrier may thus be formed with an opening in the base of each passage of a size sufficient to allow entry of the piston therethrough, but which also leaves a floor area, e.g. an annular ledge, on which the stack of packages may rest.

As stated above, the carrier may define a number of rows of stack-receiving passages, and indexing means may be provided to move the carrier in a stepwise manner under the stacking means until all the passages are filled.

The carriers may then be moved from the stacking means to the packing station by suitable means, for example a conveyor.

Individual stacks may be consolidated by being vibrated, preferably before they are inserted into their containers. Most preferably the vibration is carried out while the stacks are in the carrier.

At the packing station, the stacks of infusion packages are removed from the carriers and deposited in open-topped containers. It is envisaged that the stacks may be moved directly from the carriers to the containers, e.g. by positioning the carriers above the containers and allowing the stacks to drop down into the containers. It is however preferred that the stacks are removed into an intermediate transfer means which receives the stacks from the carriers and moves them to a position above the containers from where they are deposited into the containers.

In a particularly preferred embodiment each

container is entirely filled with stacks in one step. This avoids the need to move partially filled containers. The use of carriers that receive plural stacks of packages from which varying numbers of stacks can be removed is a particularly convenient way of achieving this, and permits containers to be filled with more than two stacks of packages simultaneously, even when the packages are produced on only a single or double stream machine. Thus, preferably the transfer means receives the necessary number of stacks to fill one or more containers in one step, and is arranged to simultaneously place into one or more than one container the number of stacks necessary to fill the container or containers. An intermediate transfer means is a particularly convenient way of placing more than two stacks of infusion packages in a container simultaneously.

Thus, according to a third aspect of the present invention, there is provided a method of manufacturing infusion packages and for inserting them into packs, comprising the steps of:

sealing doses of infusion beverage between travelling porous webs to form a two ply porous web with infusion containing pockets and cutting said pockets from the web to form infusion packages;

stacking the cut infusion packages in a horizontal orientation to form vertical stacks of packages;

inserting the vertical stacks of packages into a carrier; and

at a packing station, transferring a predetermined number of vertical stacks of infusion packages from the carrier into transfer means; moving said transfer means to a position above an open topped container configured closely to surround the stacks of packages; and depositing said stacks into said container.

According to a fourth aspect of the present invention, there is provided an apparatus for manufacturing and packaging infusion packages and

inserting them into packs, comprising:

means for sealing doses infusion beverage between travelling porous webs to form a two ply porous web with infusion containing pockets;

means for cutting these pockets from the web to form infusion packages;

means for stacking the infusion packages in a horizontal orientation to form vertical stacks of packages;

means for inserting the vertical stacks of packages into a carrier; and

at a packing station, means for removing a predetermined number of vertical stacks of infusion packages from the carrier into transfer means; means for moving said transfer means to overlie an open topped container; and means for depositing said packages into said container.

In preferred embodiments the intermediate transfer means comprises a stack receiving transfer chamber which is positionable above the carriers and into which the stacks are introduced from below. Preferably the chamber is arranged to receive the number of stacks necessary to fill a single container.

In a particularly preferred embodiment, where a container is to be filled with plural stacks of infusion packages, the stacks are urged together so as to interleave or otherwise consolidate them as they are removed into the intermediate transfer means. The transfer means can have a tapered aperture for this purpose, or where an intermediate transfer chamber is used the chamber can be tapered or have a tapered lead-in so as to urge the stacks together as they are introduced into the chamber. Alternatively the stacks can be pushed through a tapered guide before they enter the transfer means or transfer chamber. This urging together forms a more stable and integrated stack structure which is less likely to break up or otherwise lose stability when handled subsequently e.g. during

subsequent handling of the stack structure and filled container. This is desirable both from the consumer's point of view and from the point of view of maintaining a desired shape of container where a flexible container is used. It also allows the stacks to be deposited into a container having a smaller cross-sectional area than the carrier.

The stacks of infusion packages can also or instead be urged together as they are transferred from the transfer means into their container, e.g. by passing them through a tapered guide. Urging the stacks together further as they are transferred from the transfer means into their container is particularly suitable where a larger number (e.g. 4 or 6) stacks are to be urged together, i.e. there is more overall movement of the stacks necessary to consolidate them, as it permits that movement and the corresponding applied force to take place in two stages of less movement and force, i.e. as the stacks enter and leave the transfer means.

The stacks may be pushed upwardly out of the carriers by means such as push rods or the like which are movable up through the stack containing passages. The transfer chamber may then be formed with an apertured closure which can be closed around the heads of the push rods to retain the stacks, but with apertures of such size as to allow the push rods to retract. Alternatively the transfer chamber could be formed with plural elongate fingers which are able to grip and retain the stacks of packages against the force of gravity. The push rods may be individually operable or, for example, could be mounted in a desired configuration to a carriage arranged under the carrier, the carriage being capable of being raised, to raise the push rods to push out the stacks or lowered, to retract the push rods to allow the carrier to move onto its next position and to allow a new carrier to move into position below the chamber.

The transfer chamber may be moved to the mouth of the container in any convenient manner, but in the preferred embodiment it is mounted on the end of a movable arm, preferably a robotic arm.

The stacks of packages may be deposited by inserting the transfer chamber into the open container and then withdrawing the chamber whilst leaving the packages in place. This arrangement helps to avoid any disruption to the stacks that might occur if they are dropped into the containers. It is particularly applicable where the transfer chamber comprises plural elongate fingers for gripping the stacks. A plate or similar may be engaged against the tops of the stacks as the chamber is withdrawn to help retain them in the container against the movement of the chamber walls or fingers.

Preferably more than one transfer chamber is provided at the packing station to allow simultaneous filling of more than one container. For example, two or more transfer chambers may be mounted so as to receive stacks at the same time. These chambers may then be moved together to deposit the infusion packages in their containers. Preferably each chamber receives the number of stacks necessary to fill completely an individual container.

It is possible that the spacing between adjacent containers in the package receiving position will be different to that of the transfer chambers above the carriers, in which case means may be provided for adjusting the mutual spacing of the transfer chambers.

Not all the stacks in a carrier need be removed at one time. For example, if it is desired to fill a container with only two stacks of infusion packages, but the carrier holds six stacks, selected pairs of adjacent stacks may be removed into an appropriately sized transfer means, from where they are subsequently deposited into a container. To achieve this in the preferred arrangement described above, the push rods may

be selectively operable and/or positionable to extend up through a desired part of the carrier. Furthermore, the transfer chamber may be movable to overlie selected parts of the carrier to receive the stacks. Similarly, the carriers may be indexed under the chamber through a selected proportion of their length to align a desired portion thereof with the chamber.

The containers receiving the infusion packages may be conventional cartons, or, more preferably, they are flexible, bag-like containers (e.g. of paper, coated paper, plastic, metal foil or laminates composed of some or all of these materials) into which the packages may be deposited. Most preferably the container is a flexible flat-bottomed pack, which after filling may have its top sealed. The top may easily be opened by a user, and thereafter rolled or folded over to keep the contents fresh. The invention allows, for the first time, a flat-bottomed pack to be used for containing self supporting stacks of infusion packages, which can be removed directly from the package for use. Such a pack has the advantage that due to its configuration and the uniformity and density of packing of the stacks of packages therein, it is suitable for stacking, which is important for storage and at point of sale.

From a further aspect therefore, the invention provides a flexible, flat-bottomed pack containing loose stacks of infusion packages, said stacks having been packed into the pack by a method in accordance with the invention. The pack most preferably has a fin formed above its top which may be rolled or folded over to re-seal the pack after opening. A releasable resealable adhesive strip may be provided on the pack which may be releasably secured over the rolled-up fin to keep the package closed.

It will be appreciated that in all the foregoing the porous webs for forming the infusion packages can be provided by two separate webs, or by the two halves of a single web which is folded over to form a two-ply web,

as is known in the art.

A number of preferred embodiments of the invention will now be described by way of example only and with reference to the accompanying drawings, in which:-

Figure 1 is a schematic general arrangement of apparatus in accordance with the invention;

Figure 2 shows, schematically, infusion packages being produced and stacked;

Figures 3a and 3b show a stack of infusion packages being loaded into a carrier;

Figure 4 shows a front, part sectional view of carriers arranged under the transfer chambers;

Figure 5 shows a side, sectional view, of a stack of infusion packages being pushed into a transfer chamber;

Figure 6 shows schematically the stacks of infusion packages within the transfer chamber;

Figure 7 shows the transfer chambers arranged above the containers and depositing the stacks of infusion packages therein;

Figure 8 shows a top view of the filled container in Figure 7;

Figure 9 shows schematically one mode of operation of apparatus embodying the invention;

Figure 10 shows a pack of infusion packages in accordance with the invention;

Figure 11 shows a front, sectional view of carriers arranged under an alternative transfer chamber arrangement;

Figures 12a and 12b show the stack control device of Figure 11;

Figure 13 shows the interleaving guide of Figure 11;

Figure 14 shows a front, sectional view of stacks of infusion packages being pushed into the transfer chamber of Figure 11;

Figure 15 shows a side, sectional view of stacks of infusion packages being pushed into the transfer chamber

of Figure 11;

Figure 16 shows a front view of the stacks within the transfer chamber of Figure 11;

Figures 17, 18, 19, 20 and 21 show the transfer chambers of Figure 11 arranged above the containers and the depositing of the stacks of infusion packages into the containers;

Figure 22 shows a horizontal cross-section along the line A-A in Figure 18; and

Figures 23, 24 and 25 show an alternative transfer chamber arrangement.

With reference to Figure 1, an apparatus for manufacturing and packing circular infusion packages comprises in general terms, an infusion package manufacturing machine 2, and a stacking station 4, at which stacks of infusion packages are loaded into carriers 6. Loaded carriers 6 are transported by a conveyor 8 to a transfer means 10 where stacks of packages are removed from the carriers 6 and deposited in open topped containers, preferably flexible flat-bottomed, block-bottomed bags, 12 passing along a conveyor 14. The containers may be carried in cassettes on the conveyor 14, if desired. Emptied carriers 6 are returned for re-filling by a further conveyor 16.

With reference to Figures 2, 3a and 3b, the infusion packages, in this case tea bags, are produced on a standard IMA C50 or C51 machine, modified in accordance with the teachings of our earlier patent EP 422157 to produce circular packages. Infusion is dosed in piles 20 onto a first horizontally moving travelling porous web 22 by a dosing roller 24 and a second porous web 26 is then sealed over the first web 22 by heat sealing rollers 28 to produce a travelling two-ply web 30 having two rows of discrete infusion containing pockets 32. Circular infusion packages 34 are cut from the travelling web by cutting rollers 36 and the packages 34 are pushed downwardly from the web 30 into a pair of adjacent vertically arranged collation tubes 38

by a reciprocating arm 40. Waste web is collected by a vacuum head 41. Only one of the tubes 38 is shown in Figures 2 and 3, the other lying directly behind it into the plane of the Figure.

Although the infusion packages have been described as being formed from two separate webs, as is known in the art they can equally be formed by folding a single web over itself to form a two-ply web.

Carriers 6 are passed under the collation tubes 38 to receive stacks 42 of infusion packages therefrom. As can be seen from Figure 1, the carrier 6 has six open bottomed bores 44 arranged in three rows of two for receiving six stacks 42 of infusion packages in total. The carrier 6 is indexed in a stepwise manner under the collation tubes 38, so that successive pairs of bores 44 lie directly thereunder to receive successive pairs of stacks 42. If desired, detection means such as a photocell arrangement can be provided to check that the stack receiving bores 44 of the carriers are empty before they are filled.

The carrier 6 is a moulded or machined block of plastic or other material.

Infusion packages 34 entering the collation tubes 38 are prevented from falling out of the bottom of the tubes 38 by fingers 46 which project inwardly through slots 48 in the tube walls 50 and which move down the length of the tubes 38 as the tubes 38 are filled. As the stacks of infusion packages are formed, a plunger 52 is inserted from below into each tube 38, passing up through the bore 44 of the carrier 6 to support the bottom of the stack 42 therein, as shown in Figure 3a. At this point, the fingers 46 are retracted from the tubes 38. Once a predetermined number of packages 34 have been filled into the tubes 38, the fingers 46 are moved to their starting position where they are moved inwardly again to commence formation of the next stack 42, as shown in Figure 3b. The plunger 52 then moves downwardly in a controlled manner to deposit the

finished stack 42 of packages 34 in the bore 44 of the carrier. The opening 54 in the base of each bore 44 is sufficiently large to allow passage of the plunger 52 therethrough, but also sufficiently small to leave a flange 58 to support the stacks 42.

The plunger 52 is then withdrawn completely from the bore 44, and the carrier 6 then indexed to its next position at which the process is repeated, or a new carrier 6 indexed into position under the tubes 38.

As can be seen in Figure 1, filled carriers 6 are moved by a cross plunger 60 onto the conveyor 8 from where they are moved to the transfer means 10. The movement of the carriers 6 along the conveyor 8 is independent of and occurs at the same time as the filling of the next carrier 6.

The carriers 6 are queued at the end of the conveyor 8 (which is of a type which will allow the carriers in the queue to slip on its upper surface), before being pushed onto a transfer feed conveyor 62 by a piston 64. In the embodiment shown, two carriers 6 are pushed across together onto the feed conveyor 62, but of course only one, or even more, could be so moved if desired.

The transfer feed conveyor 62 moves the carriers 6 under a transfer head 70, shown in Figures 4 to 7. The conveyor 62 has indexing means associated with it so that the carriers 6 may be held in a desired position relative to the head 70, and indexed in a stepwise manner relative thereto. In the embodiment shown, two carriers 6 are released at a time and positioned together under the head 70. Other arrangements are possible, such as providing two separate pairs of carriers, one pair for each transfer chamber (of two) (see below) of the transfer head.

The transfer head 70 is mounted on the end of a robotic arm 72 and comprises a pair of transfer chambers 74. Although the transfer chambers are shown schematically close together in the drawings, for

convenience, they should be spaced apart from each other in accordance with e.g. the possible size of containers to be filled, the number of carriers to be positioned below each chamber at any one time, the desired spacings of the containers for subsequent packaging operations on them, the need to accommodate the operation of other mechanisms, and/or the desired flexibility of the process (e.g. as regards filling different sizes of container without the need to adjust or change the transfer head), etc. Thus, for example, where it is desired to be able to fill containers with one, two, four or six stacks of infusion packages using the same basic transfer head arrangement (albeit with different sized transfer chambers) and subsequent packaging arrangements, and six-bore carriers, the transfer chambers and containers are preferably spaced-apart by at least almost the length of two carriers (and two carriers are provided for each transfer chamber at any one time).

Each transfer chamber 74 is substantially rectangular in section and has at its lower end a pair of fixed, tapered, lead-in plates 76 on two opposed sides of the chamber 74. On the other two sides of the lower end of the chamber 74 are pivotally mounted a pair of apertured closure plates 78 which, in their open position taper outwardly away from the base of each chamber 74. The plates 78 are pivoted in use by pneumatic cylinders 80, or other suitable actuators mounted to the head 70.

Below the transfer head 70 is arranged a pair of parallel rails 82 on which are mounted a number of plungers 84 arranged in the same array as the bores 44 in the carriers 6. The heads 86 of the plungers 84 are of such a size that they may pass through the openings 54 in the bores 44 to lift the stacks 42 therein.

When the carriers are indexed into position under the transfer chambers 74, the position of the various components is as shown in Figure 4. The pivoted

closure plates 78 are open to receive the stacks 42. The plungers 84 are then moved vertically upwardly through the openings 54 in the carrier bores 44 to push the stacks 42 into the chambers 74. The cross-sectional area of each chamber 74 is smaller than that of the carrier, and is approximately equal to that of the container 12 into which the stacks of packages are to be filled. The tapered lead-in plates 76 and closure plates 78 act to push the stacks 42 of packages 34 together as they are introduced into the chambers 74, thereby bending the peripheral sealed portions of the individual packages 34 in each stack 42 and interleaving the stacks 42 (as shown schematically in Figure 6) to give improved stability of the stacks.

Once the stacks 42 are loaded fully into the chambers 74, the pivoted closure plates 78 are moved to their closed positions, around the plunger heads 86, which are then retracted, the portions 88 of the closure plates 78 retaining the stacks 42 in the chamber 74.

The plungers 84 are fully retracted from the carriers 6 to allow the carriers 6 to be indexed to their next position, or to allow new carriers to be introduced into position below the head 70. Empty carriers are conveyed back to the stacking means 4 by the conveyor 16.

If desired, the carrier could alternatively be emptied whilst still on the conveyor 8. In this case the conveyor 8 would index the carriers under the transfer head 70 for them to be emptied. Empty carriers would then be pushed by the piston 64 on to the conveyor 16 for returning to the stacking means 4.

Once the chambers 74 are filled, the robotic arm 72 then moves them together to a position 100 (Figure 1) over the open tops of the containers into which the stacks 42 are to be inserted. As can be seen from Figure 1, the containers 12, which in this embodiment are flexible bags, are fed along a conveyor 14. The spacing or pitch of the containers on conveyor 14 should

be selected appropriately for the filling and subsequent packaging operations. The arrangement is preferably such that the same container spacing can be used for plural different container sizes.

The transfer chambers may, if desired, be mounted on slides 102, and means (not shown) provided for moving the chambers along the slides to a desired spacing to accommodate any difference in spacing between the containers 12 on the conveyor 14 and the transfer chambers 74 on the transfer head. In this arrangement, as the head is moved into position over the containers 12 by the robotic arm 72, the chambers are moved apart by the desired amount so that they will be correctly positioned over the open mouths of the containers 12.

As stated above, the containers 12 in which the stacks 42 are deposited are flexible bags, and they have a cross-section configured to retain the stacks in the deposited configuration. As can be seen in Figures 7 and 8, in order to facilitate insertion of the stacks 42 into the bags 12, jaws 110 may be provided at the packing position which may be inserted into the open mouth 112 of the bag to hold it open. The jaws 110 can, for example, be pivotally mounted to enter the mouth 112 when the bag 12 is in the appropriate position. Alternatively suction cups could be applied to the outside of the bag to hold it open.

If desired plates can also be arranged closely adjacent to the sides of the bag to prevent those sides from distorting or bowing outwardly during the filling process. This is particularly applicable to filling larger bags, where the volume of air to be expelled from the bag as it is filled is greater, thereby leading to greater forces trying to distort the bag as it is filled. If plates are employed adjacent the sides of the bag which are transverse to the direction of motion of the conveyor 14, then these plates will need to be arranged to be retractable so that the bags can be moved into and out of the filling position.

Once the transfer head 70 is positioned closely over the bags 12, the closure plates 78 are pivoted to an open position and the stacks deposited in the bags.

Once the stacks 42 have been deposited in the bags 12, the head 70 is retracted to its original position to be refilled, whereby the process may be repeated. Once the carriers 6 at the transfer head are empty, two further loaded carriers 6 are moved into position under the head 70 and so on.

The filled bags 12 are then moved along the conveyor 14 for closing and further bags 12 are moved into the loading position to be filled by the next movement of the head 70.

The conveying and movement of carriers and filled bags between the various operation stations is preferably arranged so as to reduce or minimise that motion disturbing the stacks of infusion packages in the carriers or bags (as any such disturbance can detrimentally affect subsequent packaging processes and/or the appearance of the final product). Thus preferably abrupt changes of direction of movement of the filled carriers and filled bags are kept to a minimum, any indexing of the filled carriers and filled bags is done in relatively longer, slower steps to reduce accelerations on the carriers and bags, and the arrangement is such that the force of any clashes between filled carriers and between filled bags is minimised.

The operation of the various components of the apparatus may be controlled using a programmable control which will allow the proper coordination of the various operations, or indeed by any other suitable process control.

The embodiment described above is suitable for filling two bags 12 each with six stacks 42 of packages 34. Of course it would be possible to adapt the machine to operate with a single transfer chamber, but this would not give as high a production rate. Similarly,

more chambers could be provided, if required.

Furthermore, the apparatus may easily be modified to fill different numbers of stacks, e.g. one, two or four stacks, into differently sized bags by changing the transfer chambers 74 and the sequence in which the carriers are emptied.

For example it may be desired only to produce bags 12 which have two stacks 42 of packages 34. To achieve that, the transfer chambers may be exchanged for ones that are of a size to accommodate just two stacks of packages. It would be also possible to modify the carriers 6 to a similar configuration, having only two bores 44 in the same configuration as the chambers 74 so that carriers 6 could be moved under each chamber 74 and completely emptied at each loading stage. However, to avoid the need for producing differently sized and shaped carriers for each size of bag 12, the six bore carriers 6 as described above can still be used, with a modification to the sequence in which they are emptied of stacks 42.

With reference to Figure 9 two stacks 42 of packages 34 are to be filled into each bag 12. Two transfer chambers 74' each receiving two stacks 42 of packages are provided on a transfer head, which as shown in Figure 9 are initially placed over bores A, B, C, D in two carriers 6. Four plungers 84' are provided which are lifted upwardly to load four stacks of packages into the two chambers 74', the transfer head then moving to a position over the bags 12 which are then filled. The plungers 84' are then fully retracted and moved into position under bores A', B', C', D', and the transfer head then also moved to overlie these bores. The stacks in these bores are filled into the chambers 74' which then move over two new bags 12 to fill them. The carriers 6 are then indexed to bring bores E, F, G and H under the transfer chambers 74', which have returned to their original positions and the process repeated.

Thus the plungers 84' may be mounted to a carriage

which is movable both up and down but also in a direction transversely to the direction of movement of the carriers 6 so that if required plungers can be moved from row to row for emptying selected stacks from the carrier.

It should also be noted that both the carrier and the transfer chamber arrangements of the present embodiment are able to accommodate different heights of stacks of infusion packages, thereby making the process easily able to handle different stack heights.

Figure 10 shows a pack of tea bags packed in accordance with the invention. The pack 120 has a sealed flat, block bottom 122 which receives two stacks 124 of tea bags, packed as described above. After packing, the pack is formed with a flat top 126 and sealed at its upper end with a peelable heat seal. The top is formed with an elongate fin 128 which when the pack is first formed may be folded over and lightly adhered to the top of the pack to form a flatter, horizontal top. Once the pack is opened, as tea bags are removed, the fin can be further folded down, and retained in a closed position by a releasable resealable adhesive strip 130. This will help to reclose the pack thereby keeping the contents fresher.

Figures 11 to 22 show an alternative embodiment of the transfer means for transferring the stacks of infusion packages from the carriers to the containers.

In this embodiment the transfer chambers 74" of the transfer head 70" mounted on the end of the robotic arm (not shown) are open-sided and comprise plural elongate fingers 140 which are arranged to be able to grip stacks of infusion packages pushed between them. The fingers 140 have toothed projections 142 on their stack contacting surfaces to help grip the stacks. The teeth should be configured so as to grip the infusion packages satisfactorily, but without damaging them.

A stack control device 144 in the form of a plate having stops 146 mounted thereon arranged in the same

array as the bores in a carrier is mounted transversely in the chamber 74" for movement up and down within the outer fingers 140 by an actuating means 148, such as a pneumatic piston or an electric drive means. The stops 146 on the control device 144 act as a stop against which the stacks 42 will be lightly pressed during their loading into the fingers 140 and, as will be explained further below, as a means for assisting removal of the stacks 42 of packages from the fingers 140 in the bags 12.

Figures 12a and 12b show the control device 144 and stops 146 in more detail. Figure 12a is an underneath plan view. The device includes holes 150 and relieved regions 152 to prevent interference with the fingers 140 as it is moved. Figure 12b is a side view of the control device.

Below the transfer head 70" is arranged a pair of parallel rails 82" on which are mounted a number of plungers 84" arranged in the same array as the bores 44 in the carriers 6. The heads 86" of the plungers 84" are of such a size that they may pass through the openings in the bores 44 to lift the stacks 42 therein.

At the transfer head there is also provided an interleaving guide 154 to urge the stacks together which is fixedly mounted on the machine frame. The guide is shown in more detail in Figure 13. It is, of course, unnecessary where only a single stack is being filled into the chamber of the transfer head. The guide 154 includes a passage 156 that is shaped to correspond with the composite shape of the group of stacks. The passage 156 tapers slightly, being narrower at the top than at the bottom. Openings 158 around the sides of the interleaving guide 154 may be provided to reduce friction and facilitate the removal of jammed infusion packages.

When the carriers are indexed into position under the transfer chambers 74", the position of the various components is as shown in Figure 11. The control device

144 is in a lower position and is moved downwardly to bear lightly on top of the stacks 42. The plungers 84" are then moved vertically upwardly through the openings 54 in the carrier bores 44 to push the stacks 42 through the interleaving guide 154 and into the fingers 140. The control device 144 moves upwardly with the plungers so that the stacks are effectively sandwiched therebetween. The device 144 should be driven upwardly (i.e. not just be pushed up by the force of the stacks) but at such a rate as to maintain a light pressure on the top of the stacks that is sufficient to keep the stacks level and in alignment with each other. Movement of the stacks so held through the passage 156 in the interleaving guide 154 acts to push the stacks 42 of packages together and interleave them, thereby giving improved stability of the stacks and significantly reducing the space that they occupy.

Figure 14 shows a front view and Figure 15 is a side view of the process as the stacks are being pushed into the fingers of the transfer chamber 74". Figure 16 shows the stacks loaded into the transfer chambers between the fingers 140. The interleaving of the stacks is also completed. The peripheries of some or all of the individual infusion packages are engaged with the toothed projections 142 on the fingers 140. It should be noted that fingers may be provided in the central portion of the chamber as well as around its periphery, if desired to help hold the stacks more securely.

Once the stacks 42 are loaded fully into the fingers 140 the plungers 84" are retracted, the fingers 140 then retaining the stacks 42 in the chamber 74". The plungers 84" are fully retracted from the carriers 6 to allow the carriers 6 to be indexed to their next position, or to allow new carriers to be introduced into position below the head 70. Empty carriers are conveyed back to the stacking means 4 by the conveyor 16.

Before the plungers 84" are retracted, the control device 144 can be locked in relation to the fingers in

such a way that the stops 146 remain in contact with the top of the stacks, to ensure that its weight is supported so that it applies no pressure which might cause the stacks to be displaced downwardly.

Once the chambers 74" are filled, the robotic arm (not shown) then moves them simultaneously to a position 100 over the tops of the containers into which the stacks are to be inserted. The control device 144, if locked in position, should remain so locked during this operation. As noted above, the containers 12 which in this embodiment are flexible bags, are fed along a conveyor 14.

As stated above, the containers 12 in which the stacks are deposited are flexible bags, and they have a cross-section configured to retain the stacks in the deposited configuration. Figure 17 shows the filled chambers 74" positioned over open bags 12 ready to deposit the stacks of infusion packages therein. In order to facilitate insertion of the stacks into the bags, jaws 110" are provided at the packing position which may be inserted into the open mouth 112 of the bag to hold it open. The jaws 110" can, for example, be pivotally mounted to enter the mouth 112 when the bag 12 is in the appropriate position. The jaws have cut-outs positioned so as to provide clearance for the insertion of the fingers 140 into the bag. Alternatively suction cups could be applied to the outside of the bag to hold it open.

As in the preceding embodiment, if desired plates can also be arranged closely adjacent the sides of the bag to prevent those sides from distorting or bowing outwardly during the filling process. This is particularly applicable to filling larger bags, where the volume of air to be expelled from the bag as it is filled is greater, thereby leading to greater forces trying to distort the bag as it is filled. If plates are employed adjacent the sides of the bag which are transverse to the direction of motion of the conveyor

14, then these plates will need to be arranged to be retractable so that the bags can be moved into and out of the filling position.

Once the transfer head 70" is positioned closely over the bags 12, the fingers 140 carrying the stacks of packages are moved downwardly to fully insert them into the bags 12, as shown in Figure 18. In order to achieve a close fit of the infusion packages in the bag (preferably a slight interference fit), there should be very little clearance between the fingers 140 and the sides of the bag. This requires accurate positioning of the fingers 140 before they enter the mouths of the bags. Auxiliary guiding means 160, e.g. in the form of rollers 162, e.g. of an elastomeric material, cooperating with guideways 164 which are fixedly mounted on the machine frame, may be provided for this purpose. The guiding means could be on two opposing sides of the assembly or on three or four sides as necessary. The stack control device 144 remains fixed in relation to the fingers 140 throughout the insertion operation.

Figure 22 shows a horizontal cross-section along the line A-A in Figure 18. The positions of the fingers 140 and stacks 42 within the bag can be seen, as can the interleaving and overlapping of the stacks. There is only a small clearance between the fingers and the bag and substantially zero clearance (preferably an interference fit) between the infusion packages and the bag.

After the fingers 140 are inserted in the bags 12, they are withdrawn from the bag as shown in Figure 19. However, the stack control device 144 is maintained at a constant depth of engagement in the bag. This serves to prevent the stacks from moving upwardly with the fingers 140 with the result that the stacks are progressively stripped out of the fingers as the fingers travel upwards and therefore remain in the bag. When all the infusion packages have been stripped from out of the fingers, their upward motion is stopped. The position

is then as shown in Figure 20. If desired at this stage the stack control device 144 can be caused to further descend into the bag to press the stops 146 on the tops of the stacks, with or without the incorporation of vibration, in order to further level up the stacks' top surfaces.

Once the stacks 42 have been deposited in the bags 12, the transfer head is moved upwardly to fully disengage the bag and the jaws release the top of the bags, as shown in Figure 21. The head can then be retracted to its original position to be refilled, whereby the process may be repeated. Once the carriers at the transfer head are empty, two further loaded carriers are moved into position under the head 70" and so on.

The filled bags are then moved along the conveyor 14 for closing and further bags are moved into the loading position to be filled by the next movement of the head 70".

This embodiment of the transfer process may be advantageous in that it avoids the need to drop the stacks of packages into the containers, and thus any disruption to the stacks that such dropping might cause.

Figures 23 to 25 show a further alternative embodiment of the transfer means for transferring the stacks of infusion packages from the carriers to the containers.

In this alternative arrangement, the transfer means is similar to the transfer head of figures 4, 5, and 7, but each the transfer chamber 74''' additionally includes a plate 170 which is mounted transversely in the chamber 74''' for movement up and down within the chamber 74''' by a pneumatic piston 172 or equivalent actuating means. This plate 170 acts as a stop against which the stacks 42 will be pressed lightly during their loading into the chambers 74''' and, as will be explained further below, as a means for subsequently discharging the stacks 42 of packages from the chambers

74''' into the bags 12.

As before, the carriers are indexed into position under the transfer chambers 74'''. The position of the various components is then as shown in Figure 23. The plates 170 are in a lower position with the pivoted closure plates 78 open to receive the stacks 42. The plungers 84 are then moved vertically upwardly through the openings in the carrier bores to push the stacks 42 into the chambers 74'''. The plates 170 move upwardly with the plungers so that the stacks 42 are effectively sandwiched therebetween. Each plate 170 should be driven upwardly (i.e. not just be pushed up by the force of the stacks) but at such a rate as to maintain a light pressure on the top of the stacks that is sufficient to keep the stacks level and in alignment with each other.

The chambers 74''' are filled as before, with the stacks 42 of packages being pushed together as they are introduced into the chambers 74''' to give improved stability of the stacks. The robotic arm 72 then moves the chambers together to a position over the open tops of the containers into which the stacks 42 are to be inserted.

Once the transfer head 70''' is positioned closely over the bags 12, the closure plates 78 are pivoted to an open position and the stacks are pushed out of the chambers 74''' by the plates 170 which are moved downwardly. This movement is conducted at high acceleration so that the stacks 42 do not have opportunity to fall under gravity into the bags 12. Furthermore, plates 170 continue to move downwardly until the bottoms of the stacks reach the bottom of the bag, and are then allowed to dwell on the tops of the stacks for a short period so that individual packages are prevented from being displaced from the stack due to bouncing which might otherwise occur.

As before once the stacks 42 have been deposited in the bags 12, the head 70''' is retracted to its original position for refilling, whereby the process may be

repeated.

Whilst the above embodiments have been described in the context of filling bag-like flexible open topped containers, it is equally applicable to filling other containers such as cartons. Furthermore, circular tea bags are quoted as an example only of infusion packages which can be packed by the method of the invention. It is equally applicable to other beverage infusions such as coffee grounds, camomile and so on, and to other shapes of packages, such as rectangular packages, non-geometrically shaped packages, etc, including tagged infusion packages. In the case of tagged infusion packages, it may, as will be appreciated by those skilled in the art, be necessary to alternate different orientations of the infusion packages in each stack so as to ensure that the top of the stack lies substantially horizontally, in spite of the extra bulk of the tags.

Claims

1. A method of manufacturing infusion packages and for inserting them into packs, comprising the steps of:

sealing doses of infusion beverage between travelling porous webs to form a two ply porous web with infusion containing pockets and cutting said pockets from the web to form infusion packages;

stacking the cut infusion packages in a horizontal orientation to form vertical stacks of packages;

inserting the vertical stacks of packages into a carrier;

transporting said carrier, after it has received a predetermined number of vertical stacks of packages, to a packing station remote from the stacking location; and

at the packing station, removing a predetermined number of vertical stacks of infusion packages from the carrier and placing said stacks into an open topped container configured closely to surround the stacks of packages.

2. The method of claim 1, comprising stacking two stacks of packages in the carrier simultaneously.

3. The method of claim 1 or 2, comprising filling plural successive carriers with stacks of infusion packages, the individual carriers being independent from one another.

4. The method of claim 1, 2 or 3, further comprising vibrating the stacks of infusion packages so as to consolidate them, before packing them into the container.

5. The method of claim 4, comprising vibrating the stacks while they are in the carrier.

6. The method of any one of the preceding claims,

comprising moving the stacks closer together during packing to consolidate them.

7. The method of any one of the preceding claims, wherein each container is entirely filled with stacks in one step.

8. The method of any one of the preceding claims, further comprising removing the stacks into a transfer means which receives the stacks from the carriers and moves them to a position from where they are deposited into the containers.

9. A method of manufacturing infusion packages and for inserting them into packs, comprising the steps of:

sealing doses of infusion beverage between travelling porous webs to form a two ply porous web with infusion containing pockets and cutting said pockets from the web to form infusion packages;

stacking the cut infusion packages in a horizontal orientation to form vertical stacks of packages;

inserting the vertical stacks of packages into a carrier; and

at a packing station, transferring a predetermined number of vertical stacks of infusion packages from the carrier into transfer means; moving said transfer means to a position above an open topped container configured closely to surround the stacks of packages; and depositing said stacks from said transfer means into said container.

10. The method of claim 8 or 9, wherein the transfer means receives the necessary number of stacks to fill one or more containers in one step, and is arranged to simultaneously place into one or more than one container the number of stacks necessary to fill the container or containers.

11. The method of claim 8, 9 or 10, further comprising urging the stacks of infusion packages together so as to interleave or otherwise consolidate them as they are removed into the transfer means.

12. The method of claim 8, 9, 10 or 11, further comprising urging the stacks of infusion packages together so as to interleave or otherwise consolidate them as they are discharged from the transfer means into the container.

13. The method of any one the preceding claims, wherein only selected stacks are removed from a carrier at one time for filling into the container.

14. The method of any one of the preceding claims, wherein said container is a flexible, flat-bottomed pack.

15. The method of claim 14, comprising holding the mouth of said pack open to facilitate introduction of the stacks.

16. An apparatus for manufacturing infusion packages and for inserting them into packs, comprising:

means for sealing doses of infusion beverage between travelling porous webs to form a two ply porous web with infusion containing pockets;

means for cutting these pockets from the web to form infusion packages;

means for stacking the infusion packages in a horizontal orientation to form vertical stacks of packages;

means for inserting the vertical stacks of packages into a carrier;

means for transporting the carrier, after it has received a predetermined number of vertical stacks of infusion packages, to a packing station remote from the

stacking means; and

at the packing station, means for removing a predetermined number of vertical stacks of infusion packages from the carrier and transferring them into an open topped container.

17. The apparatus of claim 16, further comprising plural carriers, each carrier being configured to provide vertically oriented stack receiving passages to receive at least one or two vertical stacks of packages, the carriers being movable independently of each other.

18. The apparatus of claim 17, wherein each carrier comprises a block having a number of stack receiving passages in the form of bores sized to receive the packages.

19. The apparatus of claim 17 or 18, further comprising means for controlling the positioning of the stacks within the stack-receiving passages of the carrier as they are deposited therein.

20. The apparatus of claim 16, 17, 18 or 19, wherein the carrier defines a number of rows of stack-receiving passages, and the apparatus further comprises indexing means for moving the carrier in a stepwise manner under the stacking means until all the passages are filled.

21. The apparatus of any one of claims 16 to 20, further comprising means for vibrating the stacks of infusion packages so as to consolidate them.

22. The apparatus of any one of claims 16 to 21, comprising transfer means for transferring stacks of packages from said carrier to said container.

23. An apparatus for manufacturing and packaging infusion packages and inserting them into packs,

comprising:

means for sealing doses of infusion beverage between travelling porous webs to form a two ply porous web with infusion containing pockets;

means for cutting these pockets from the web to form infusion packages;

means for stacking the infusion packages in a horizontal orientation to form vertical stacks of packages;

means for inserting the vertical stacks of packages into a carrier; and

at a packing station, means for removing a predetermined number of vertical stacks of infusion packages from the carrier into transfer means; means for moving said transfer means to overlie an open topped container; and means for depositing said packages from said transfer means into said container.

24. The apparatus of claim 22 or 23, wherein the transfer means is arranged to receive the necessary number of stacks to fill one or more containers in one step, and is arranged to simultaneously place into one or more than one container the number of stacks necessary to fill the container or containers.

25. The apparatus of claims 22, 23 or 24, wherein said transfer means comprises a stack receiving transfer chamber movable from a position in which it can receive stacks from the carriers to a position from where the stacks can be deposited into the containers.

26. The apparatus of claim 22, 23, 24 or 25, further comprising means for urging the stacks of infusion packages together so as to interleave or otherwise consolidate them as they are removed into the transfer means.

27. The apparatus of claim 25 and 26, wherein the

transfer chamber or the lead-in thereto is tapered so as to urge said stacks together as they are introduced into said chamber.

28. The apparatus of claim 22, 23, 24, 25, 26 or 27, further comprising means for urging the stacks of infusion packages together so as to interleave or otherwise consolidate them as they are discharged from the transfer means into the container.

29. The apparatus of any one of claims 22 to 28, wherein said transfer means comprises a plurality of stack transferring chambers movable simultaneously to fill a plurality of containers.

30. The apparatus of any one of claims 16 to 29, comprising means for removing only selected stacks from a carrier at one time.

31. The apparatus of any one of claims 16 to 30, comprising means for holding open the mouth of the container to facilitate the introduction of stacks of packages thereinto.

32. A flexible, flat-bottomed pack containing stacks of infusion packages, said stacks having been packed into the pack by a method in accordance with any one of claims 1 to 15 or by using an apparatus in accordance with any one of claims 16 to 31.

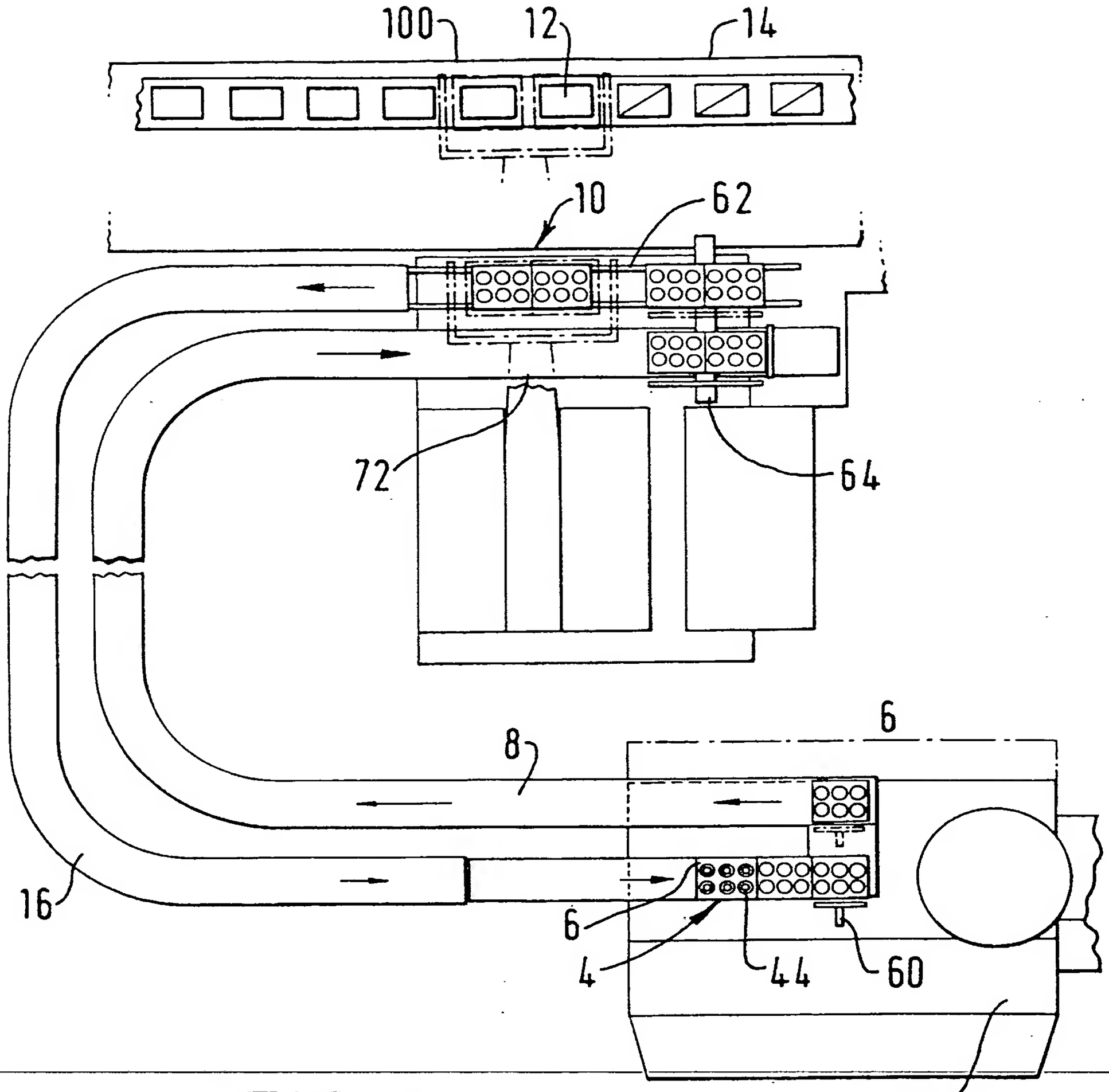


FIG. 1.

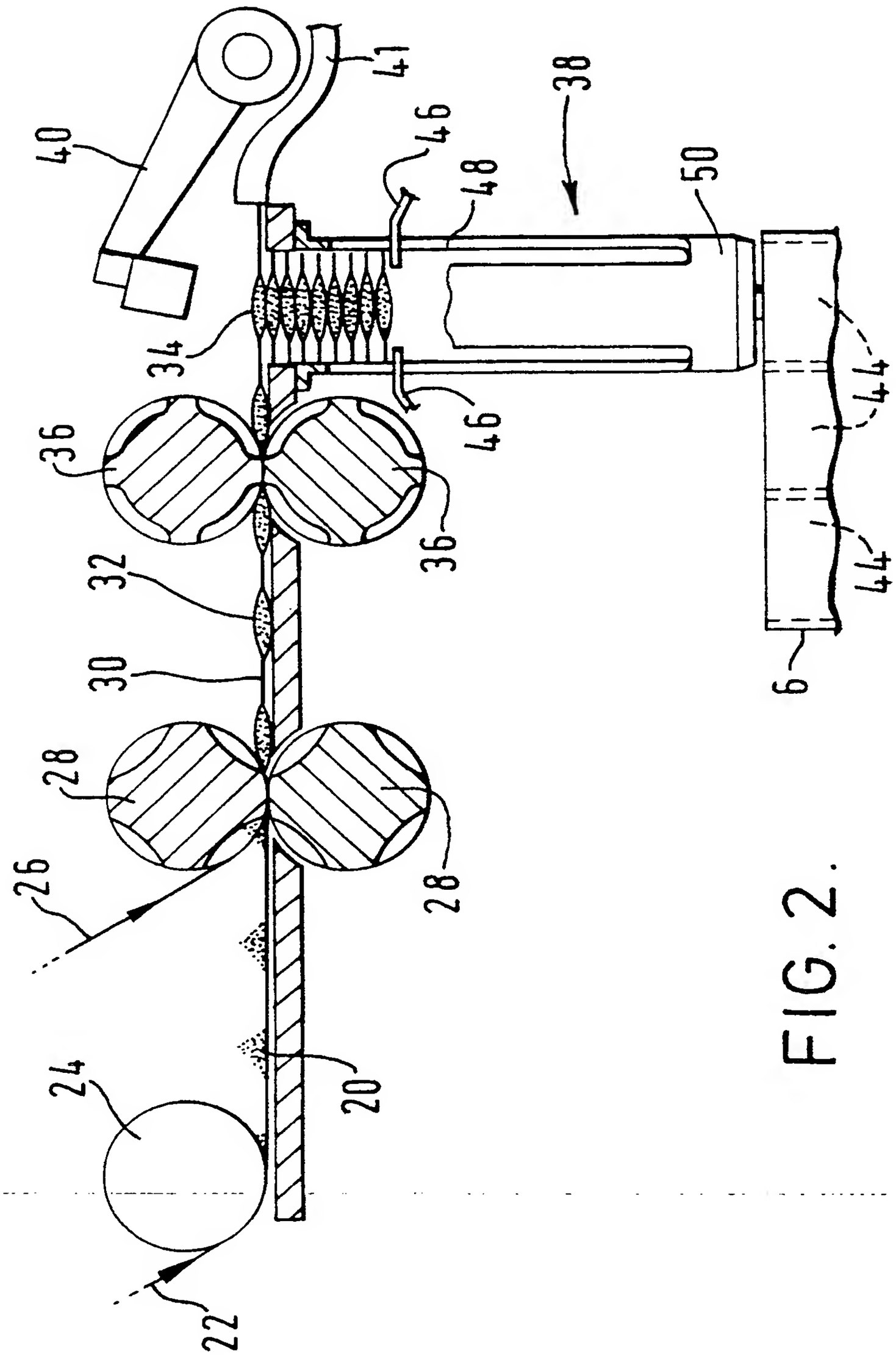


FIG. 2.

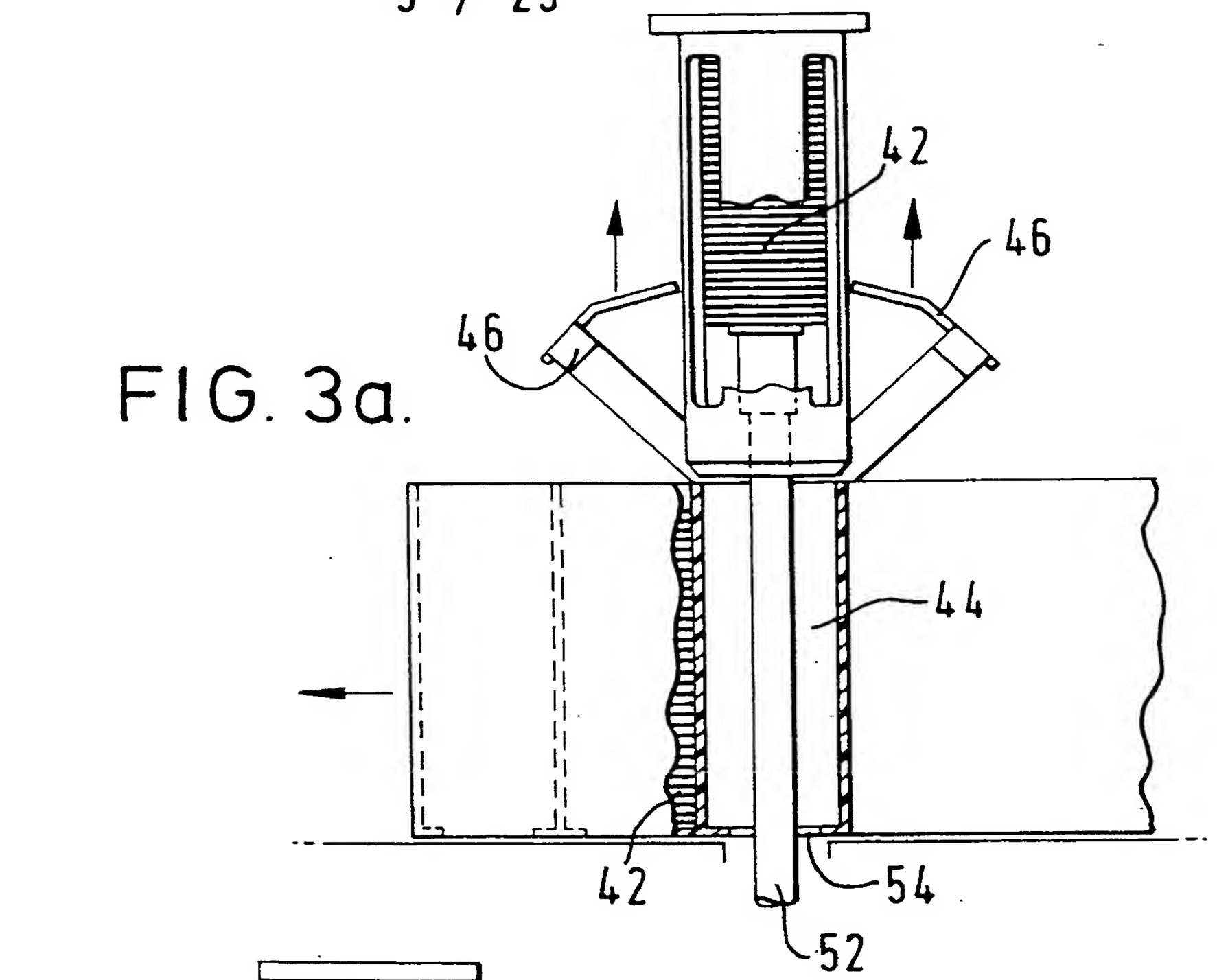


FIG. 3a.

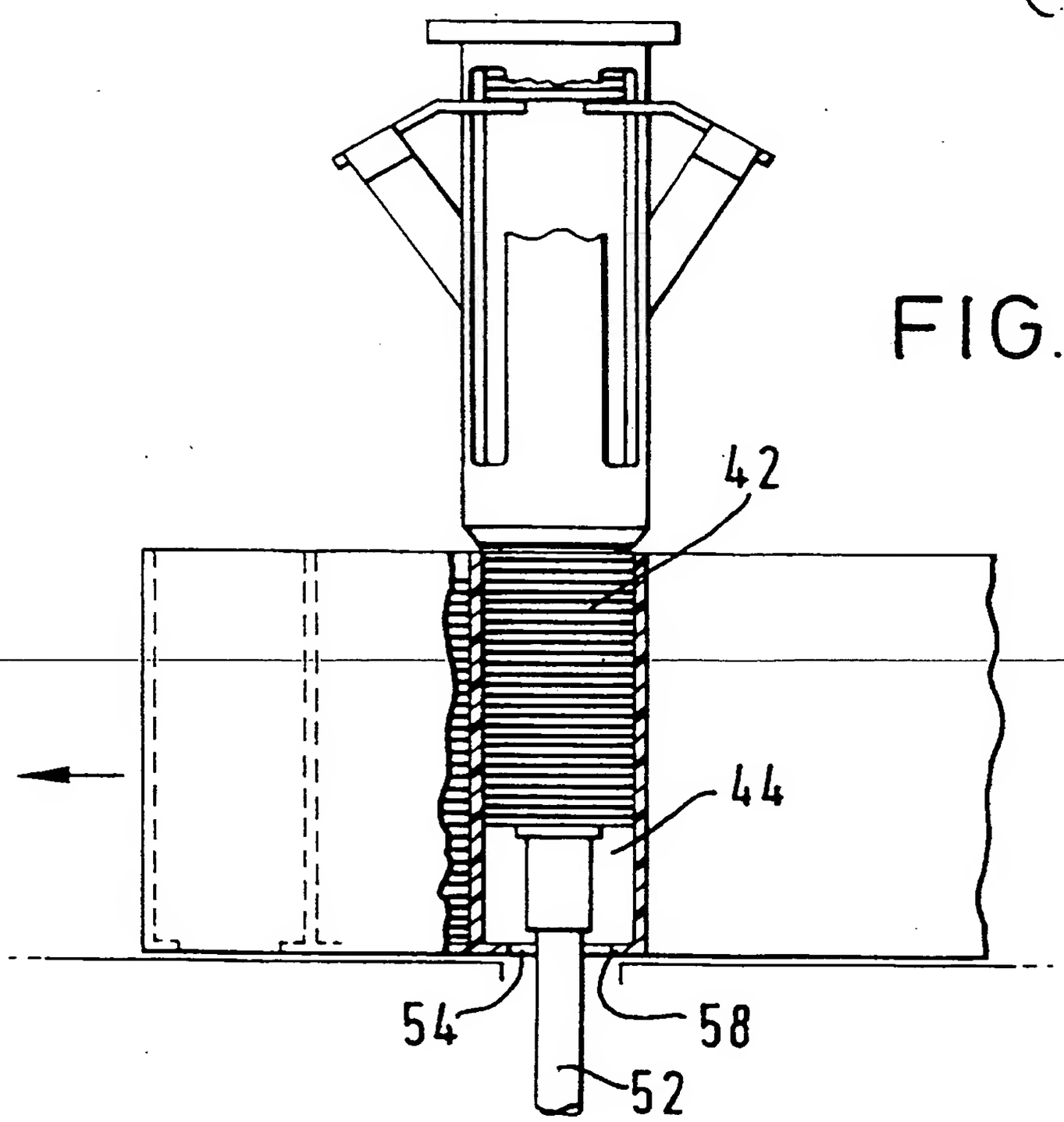


FIG. 3b.

FIG. 4.

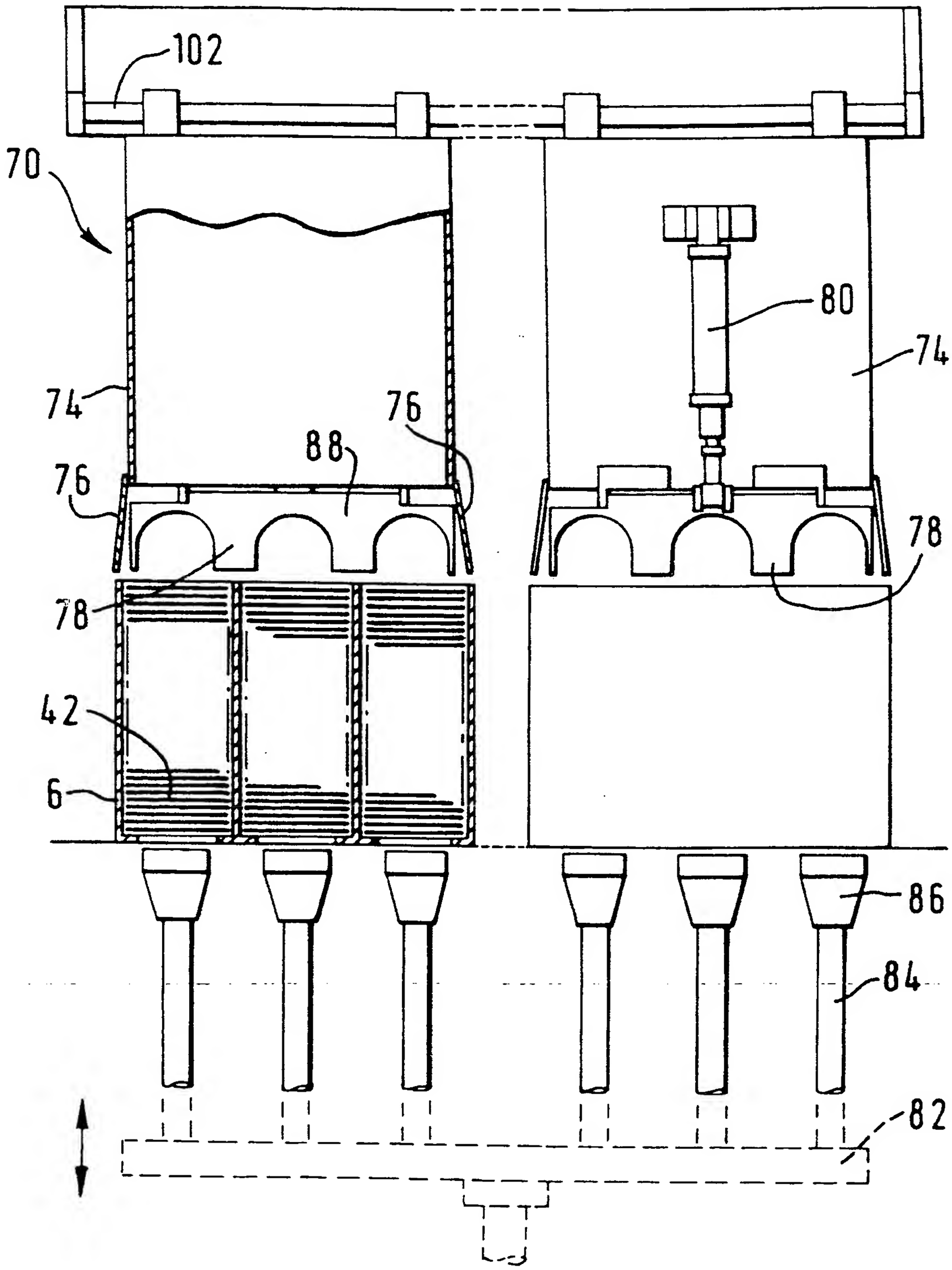


FIG.5.

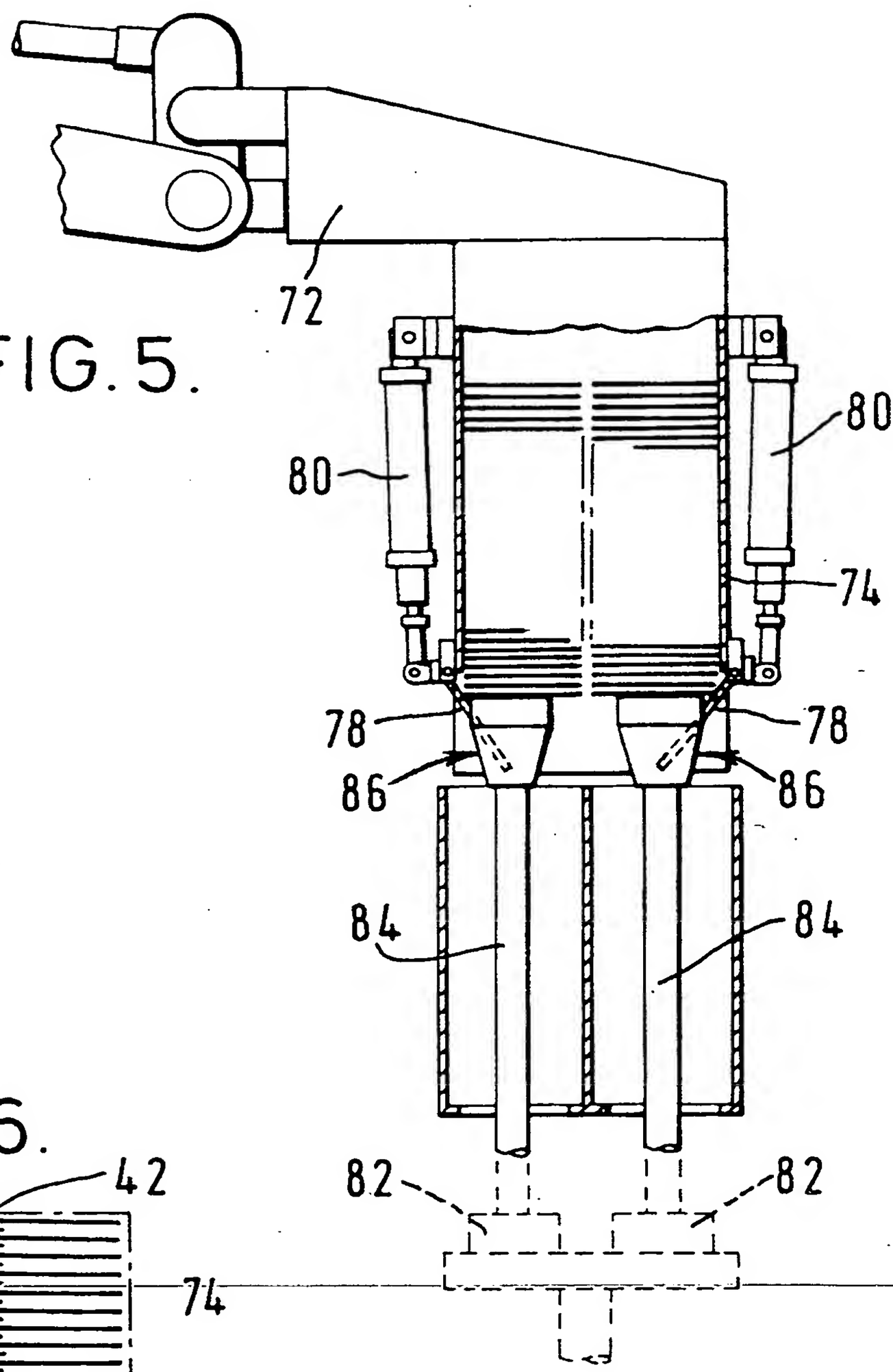


FIG.6.

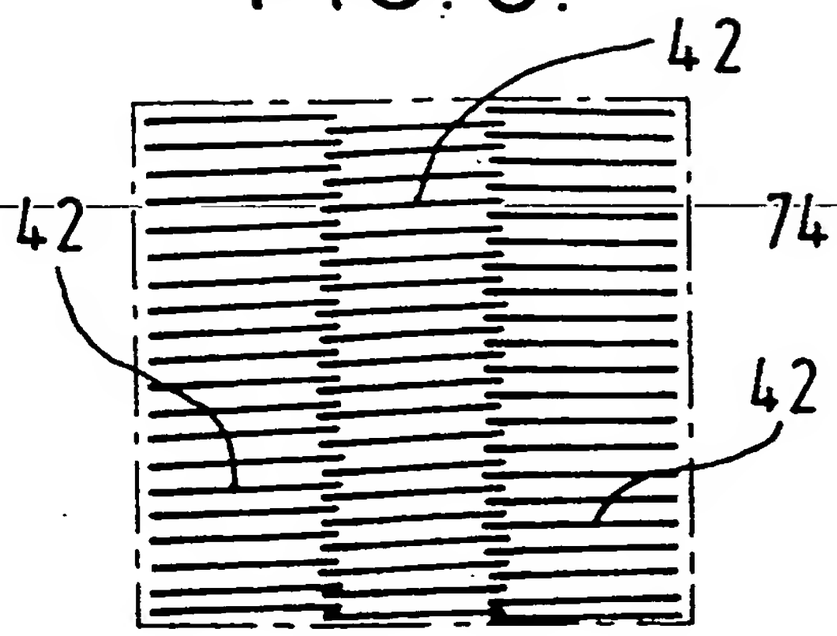


FIG.7.

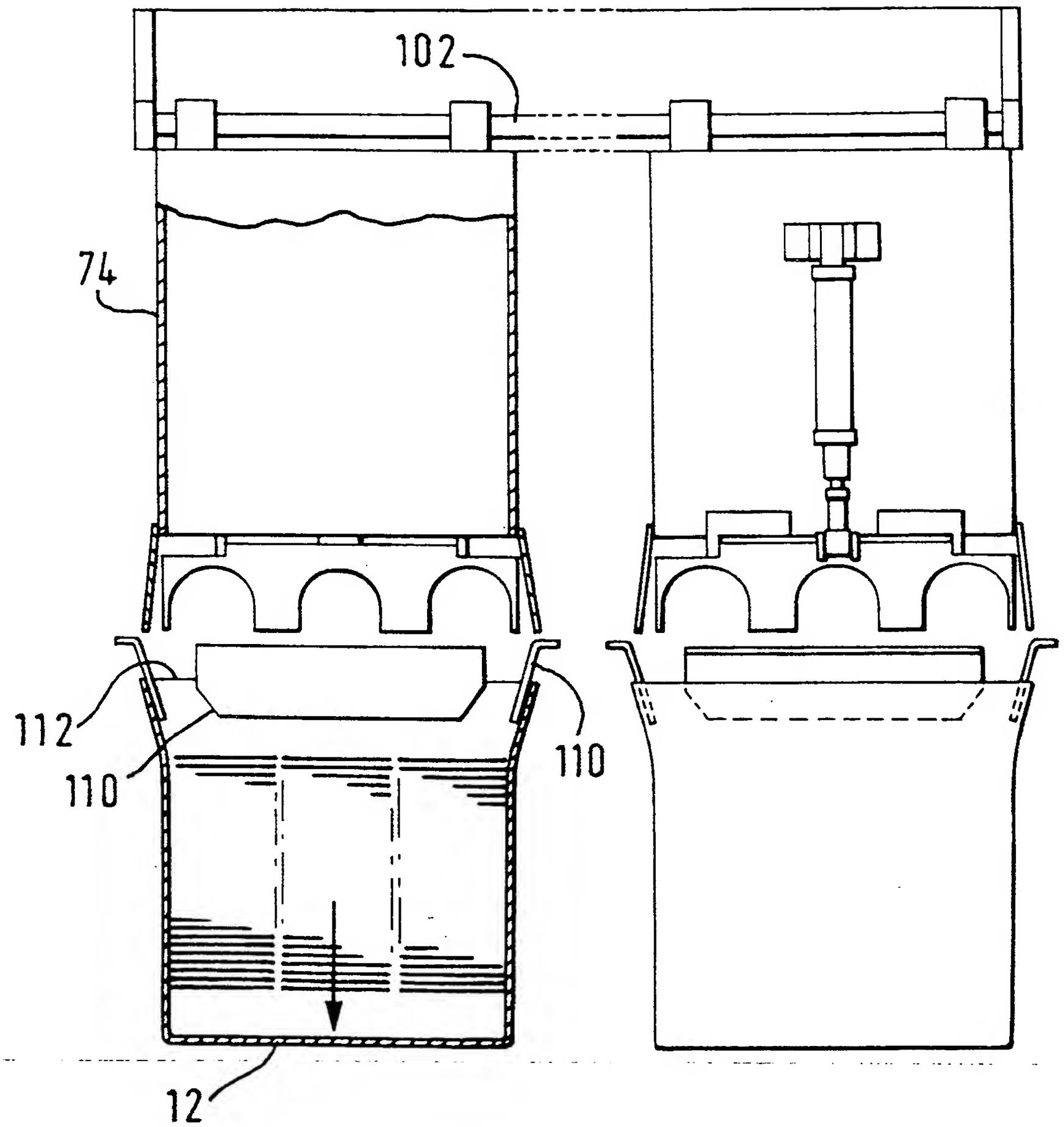


FIG. 8.

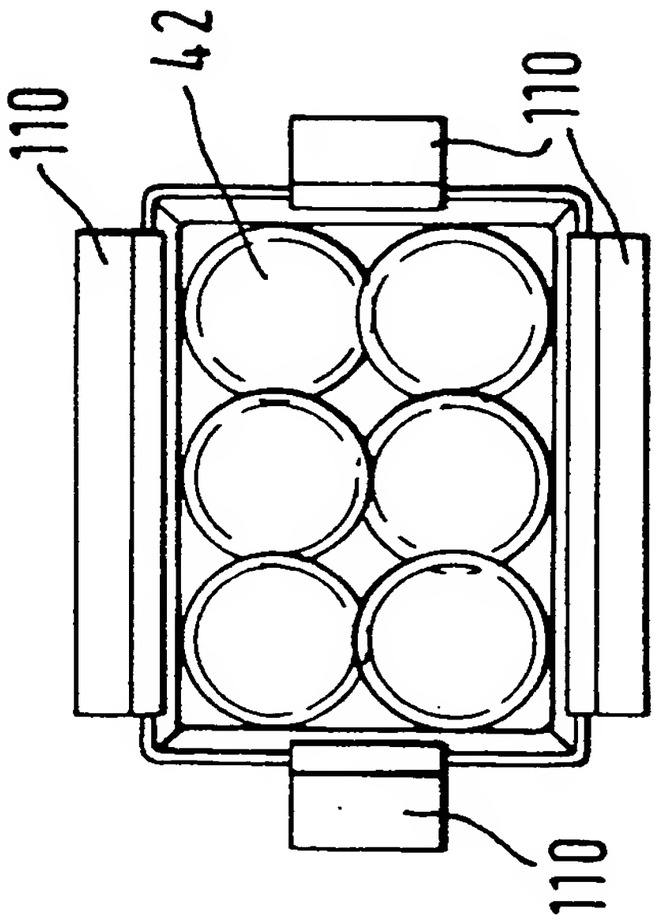

110
42
110
110

FIG. 9.

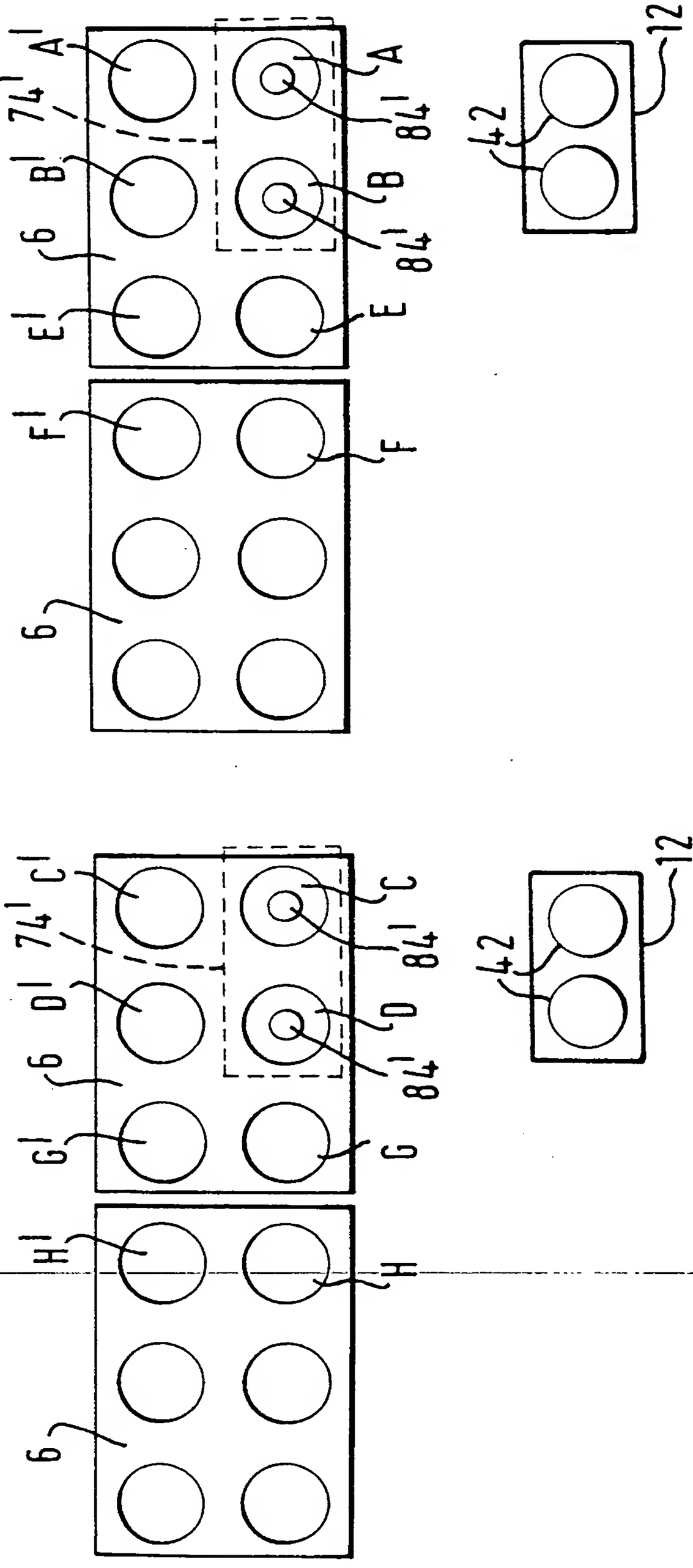

A'
74'
B'
6
E'
A
84'
B
84'
E
12
42
F'
F
6
C'
D'
74'
6
G'
C
84'
D
84'
G
12
42
H'
H
6

FIG. 10.

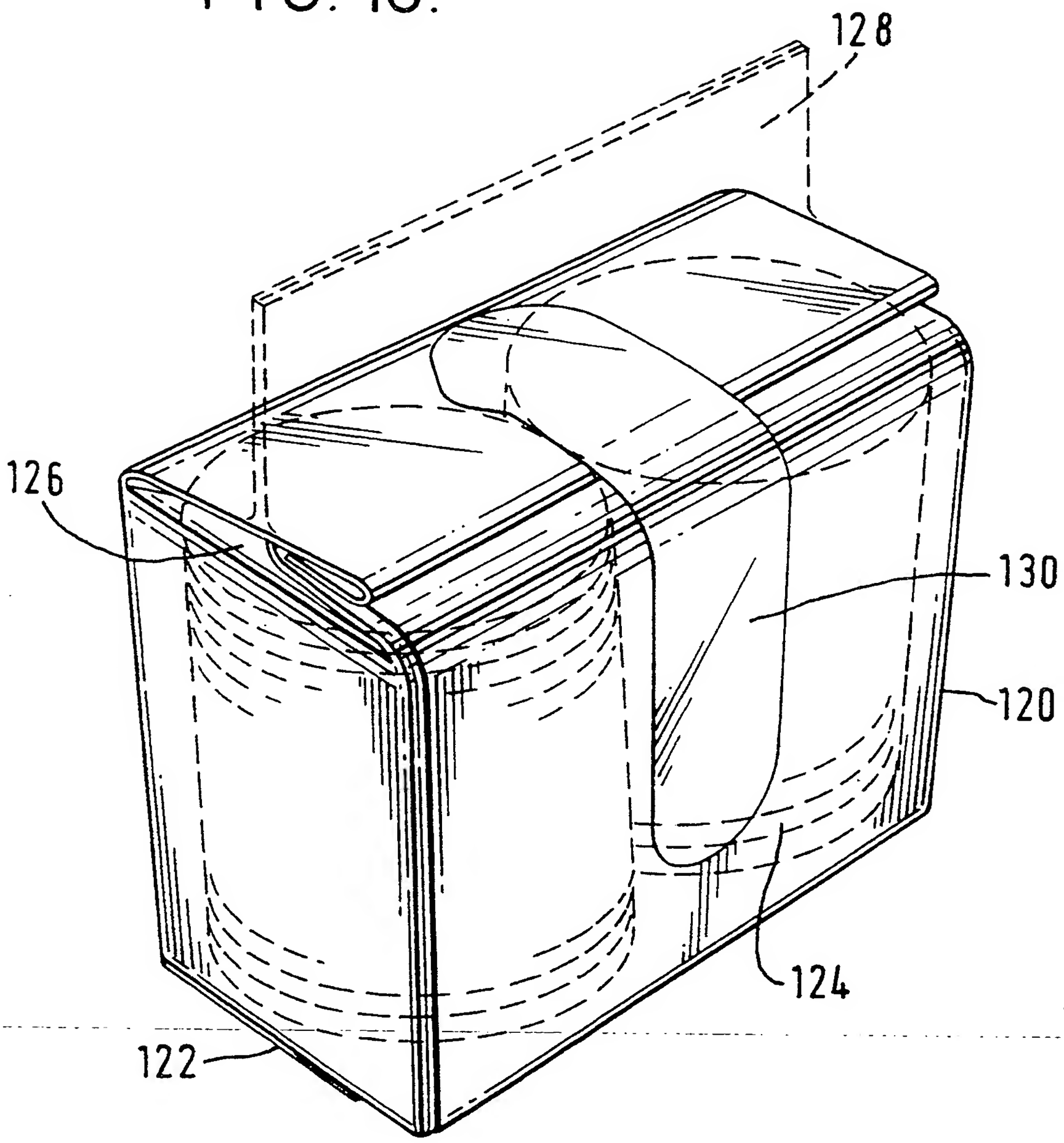
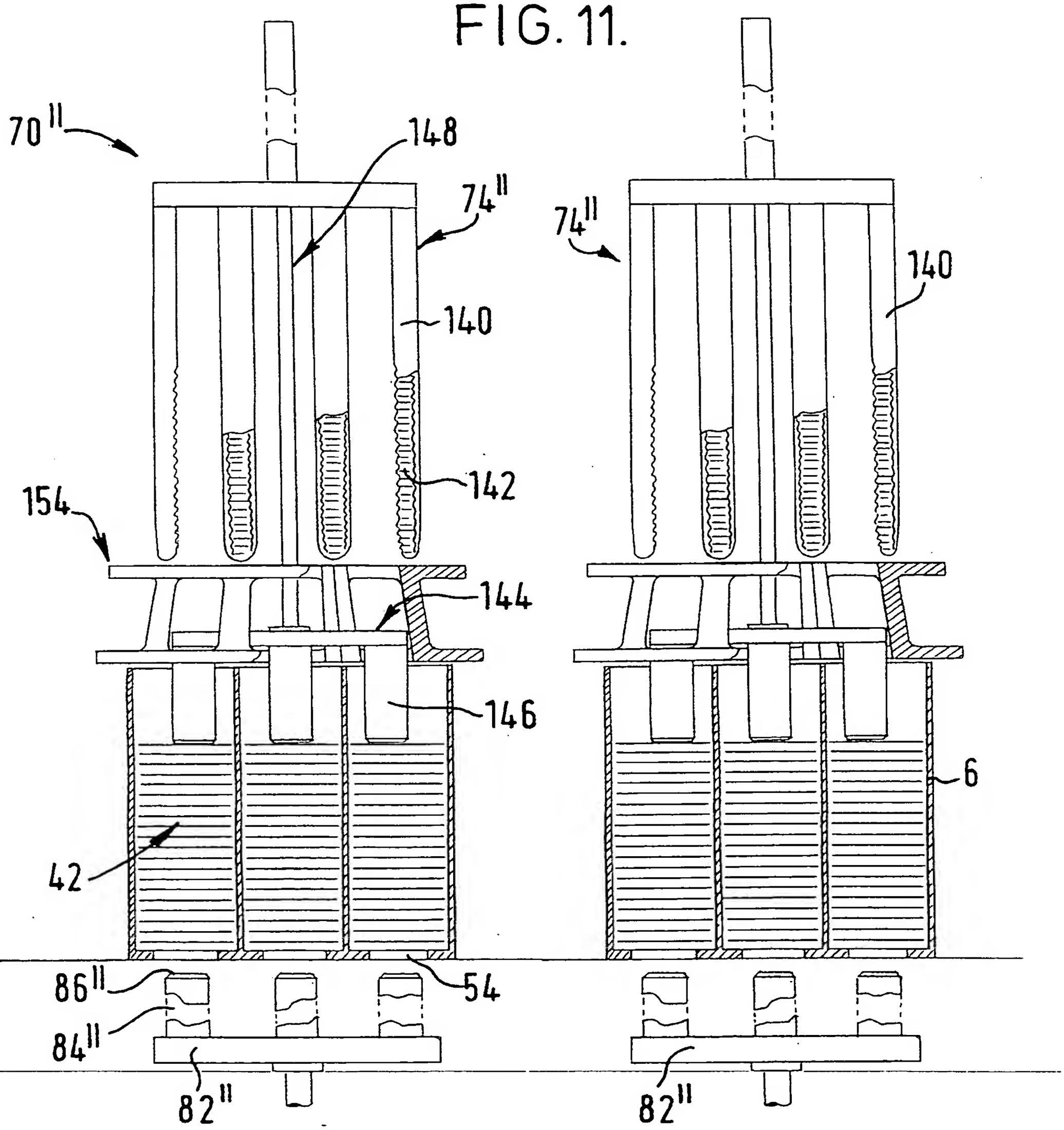


FIG. 11.



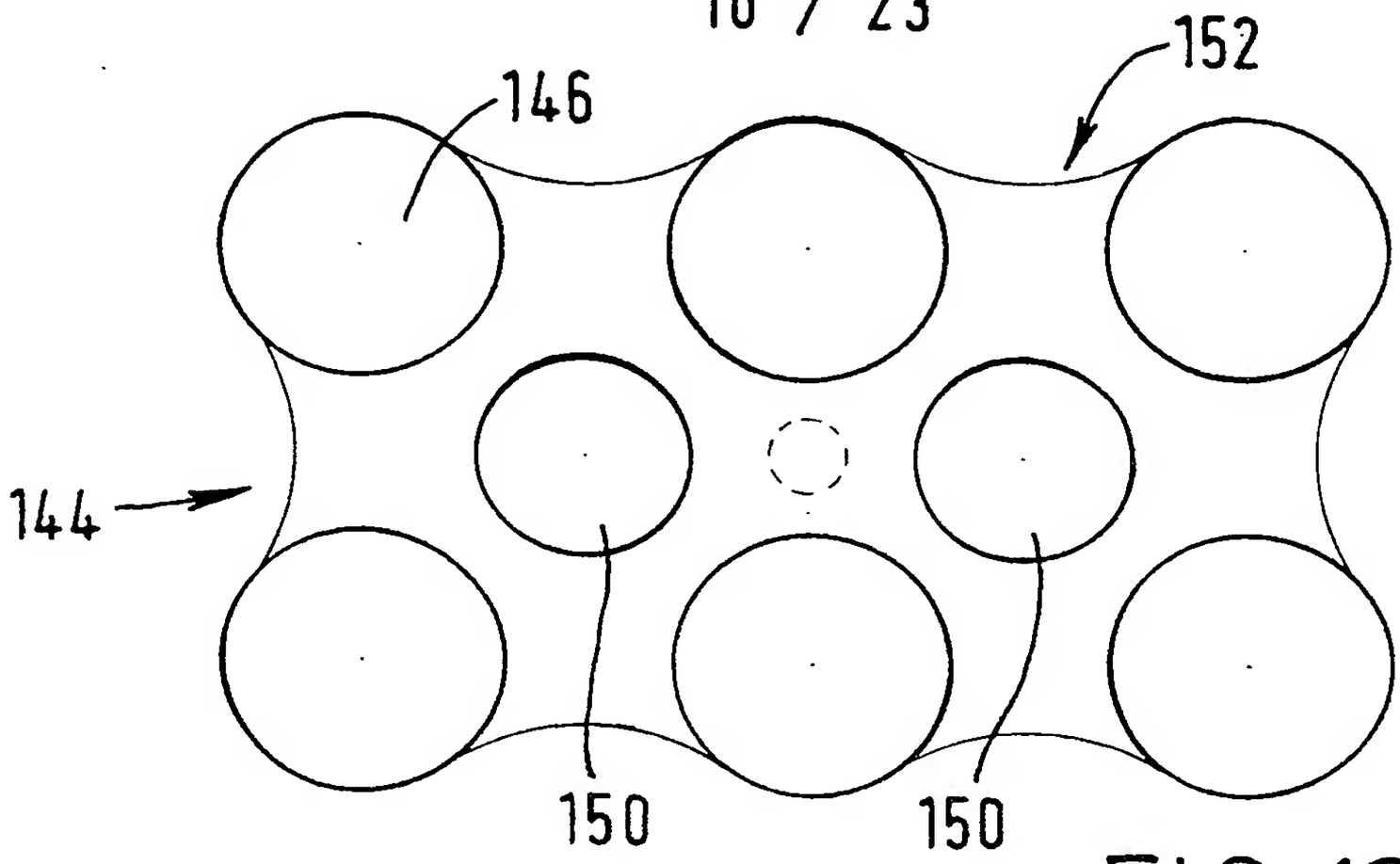


FIG. 12a.

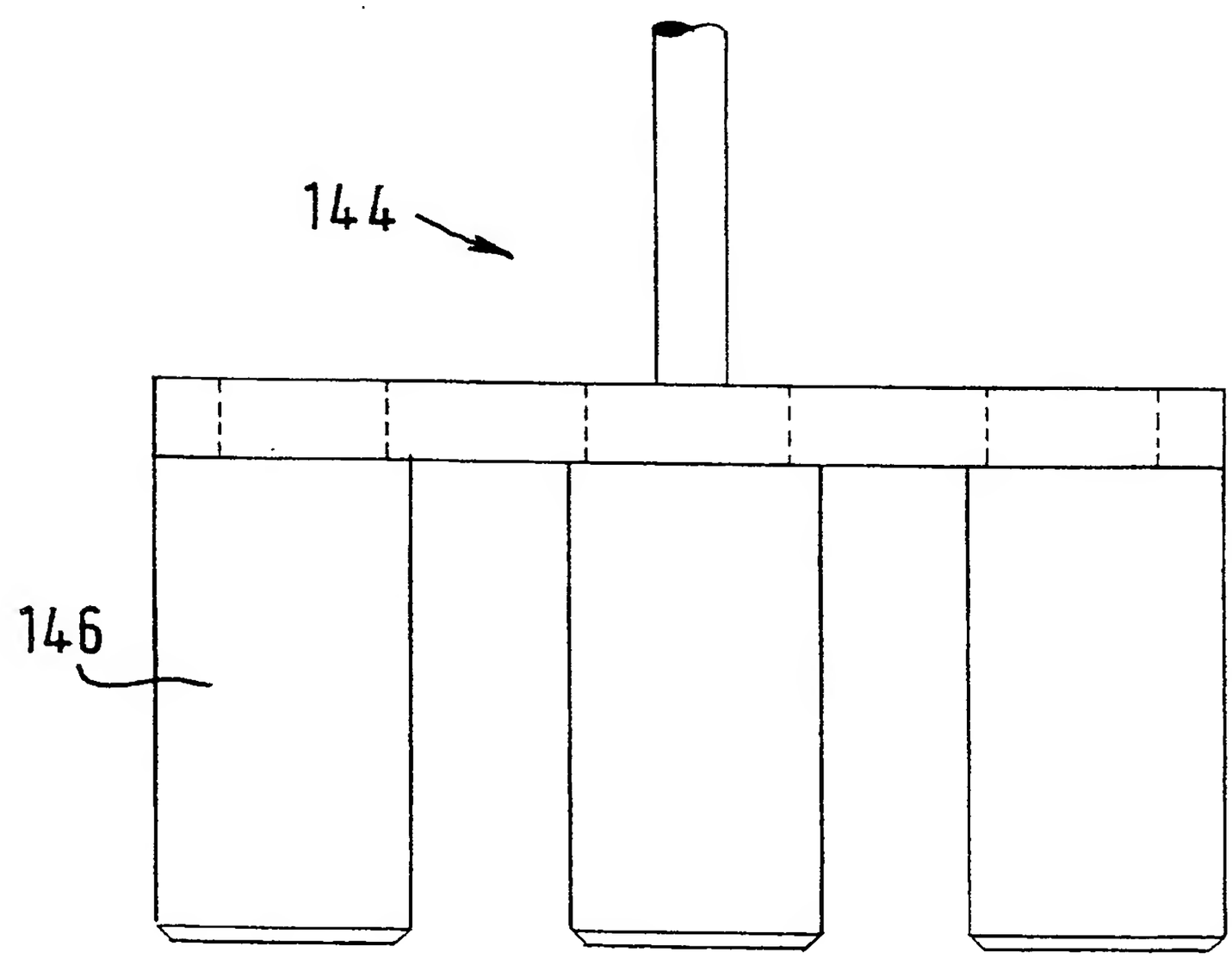


FIG. 12b.

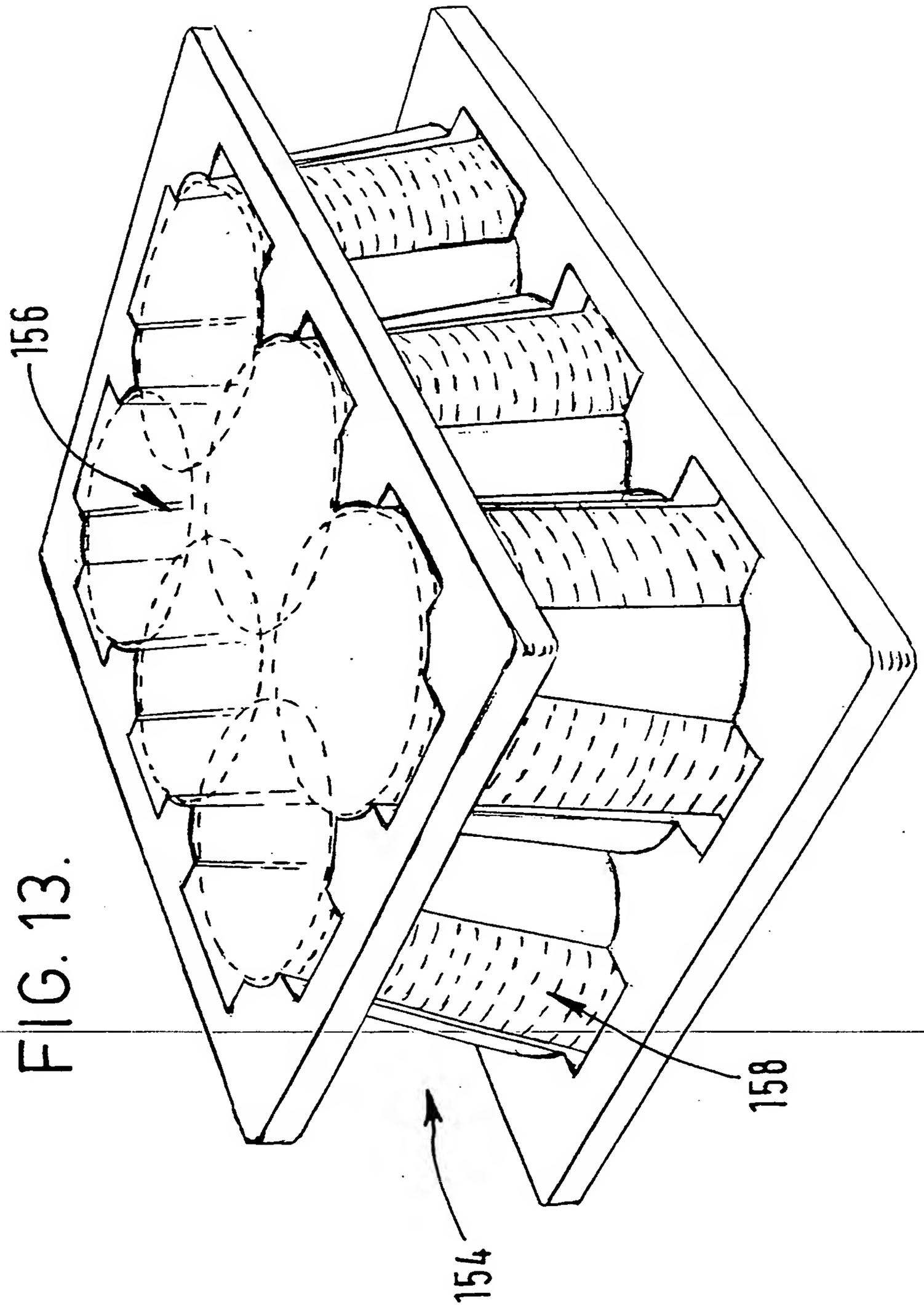


FIG. 13.

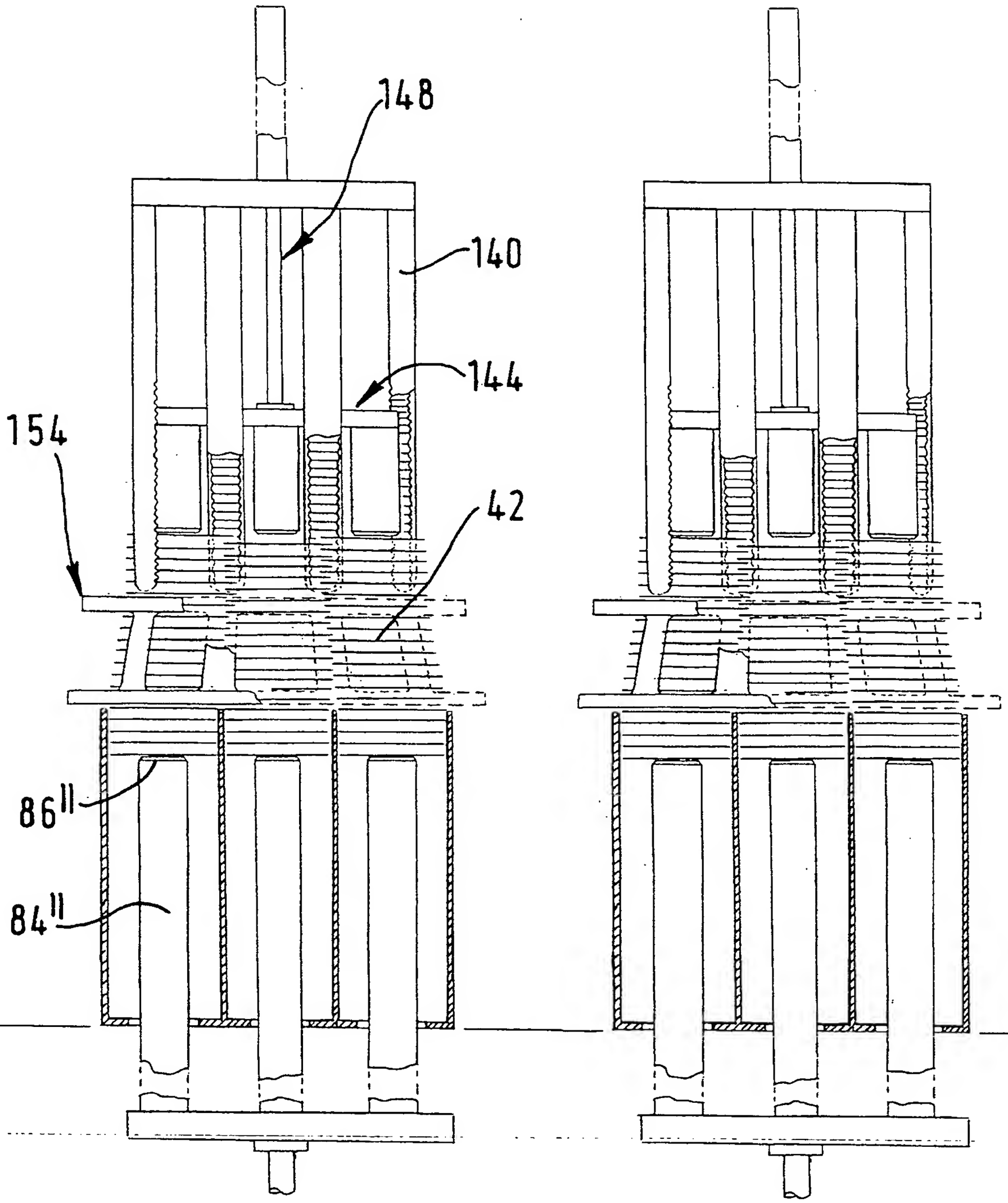


FIG. 14.

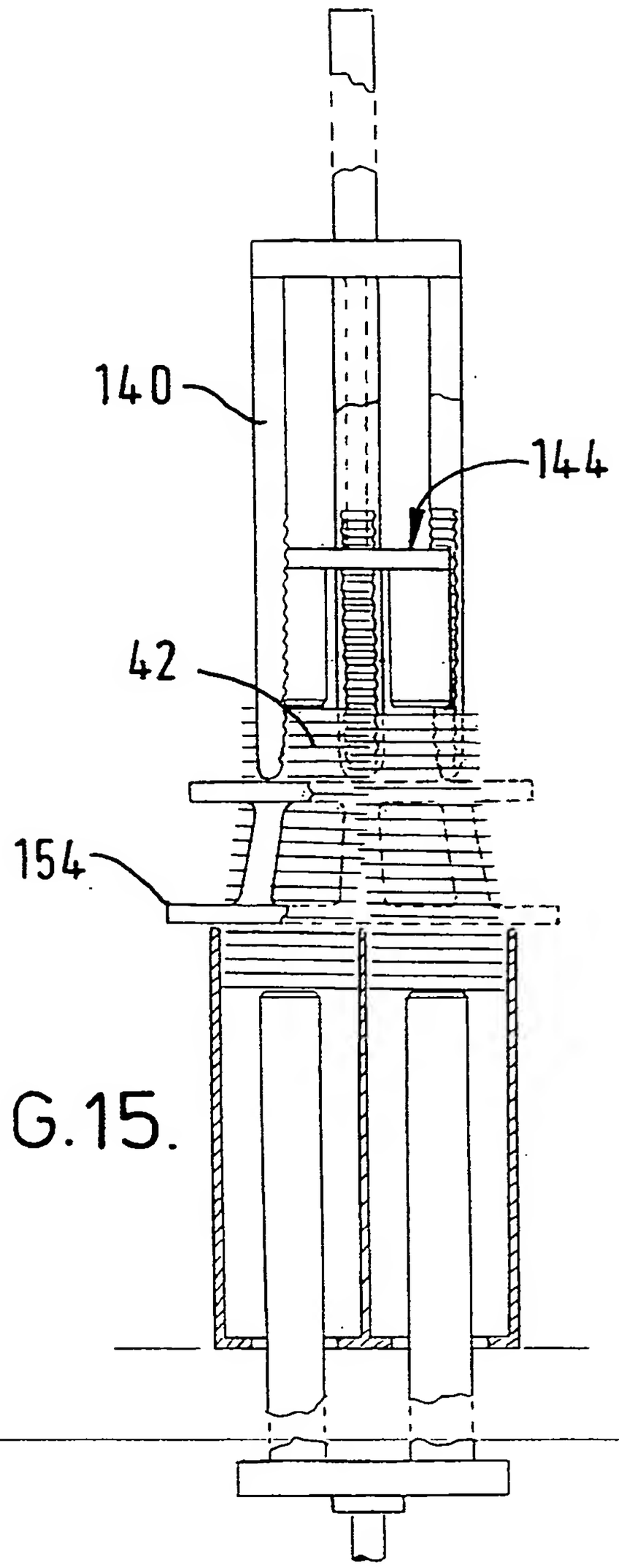


FIG.15.

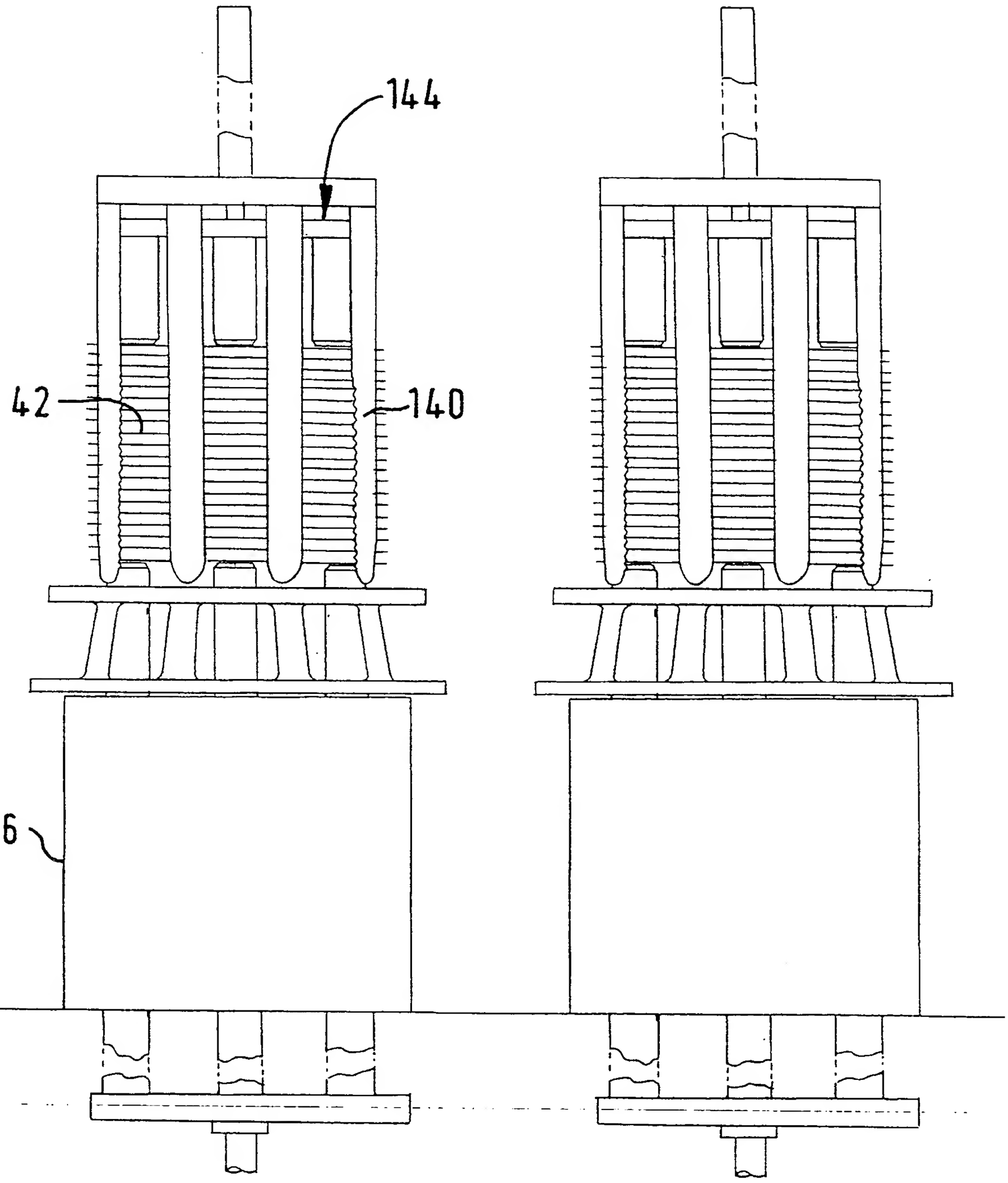


FIG.16.

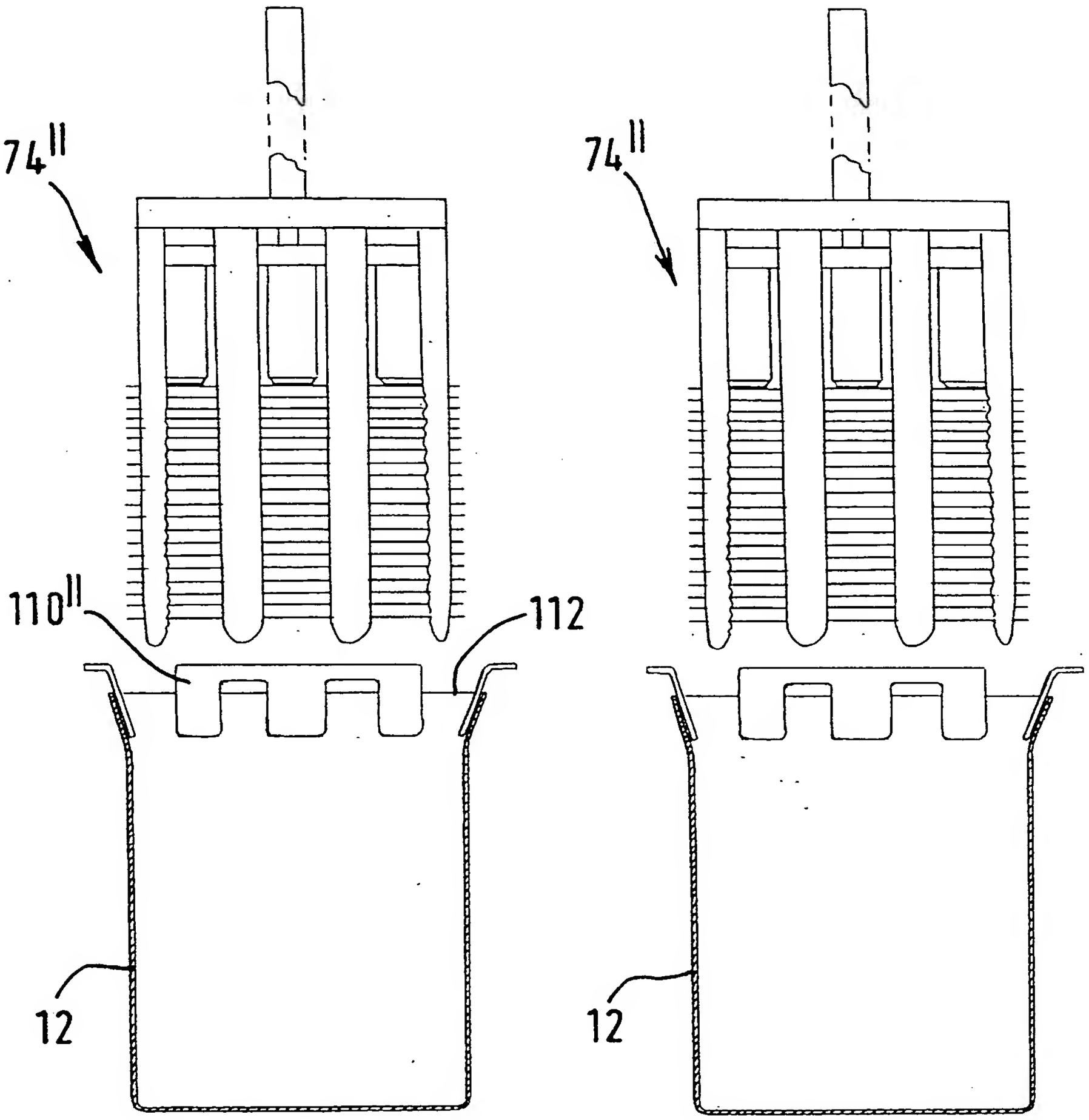


FIG. 17.

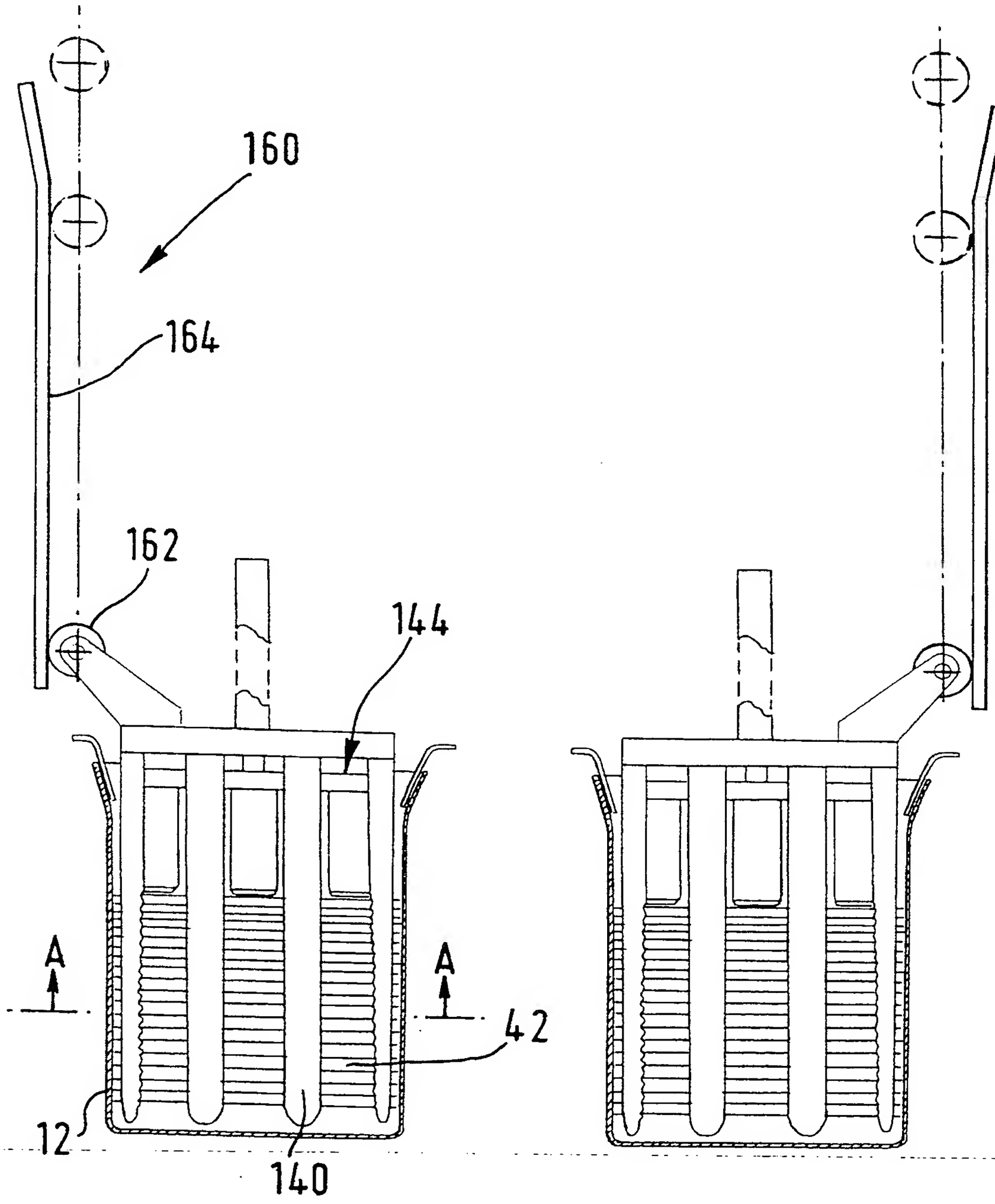


FIG. 18.

FIG. 19.

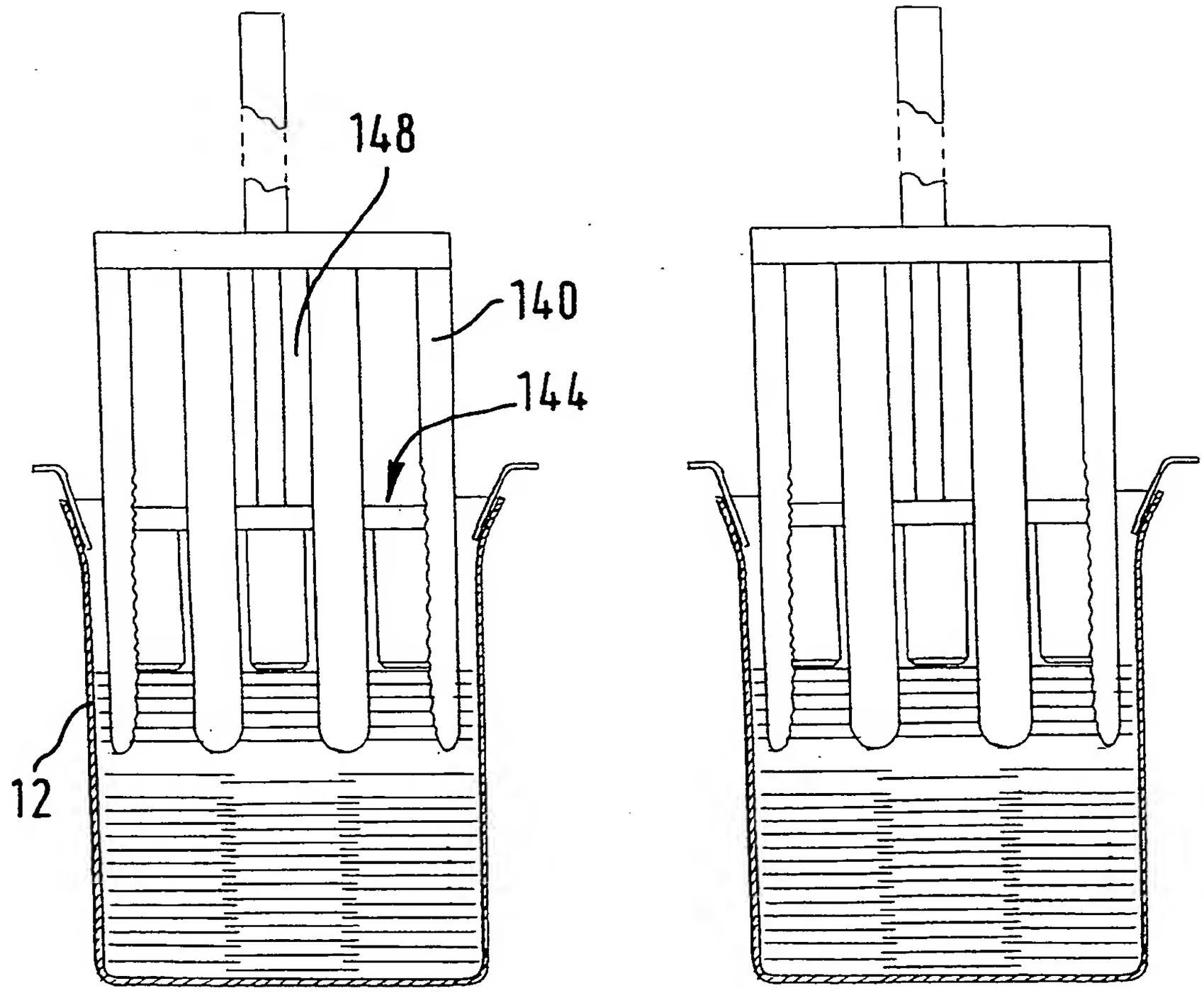


FIG. 20.

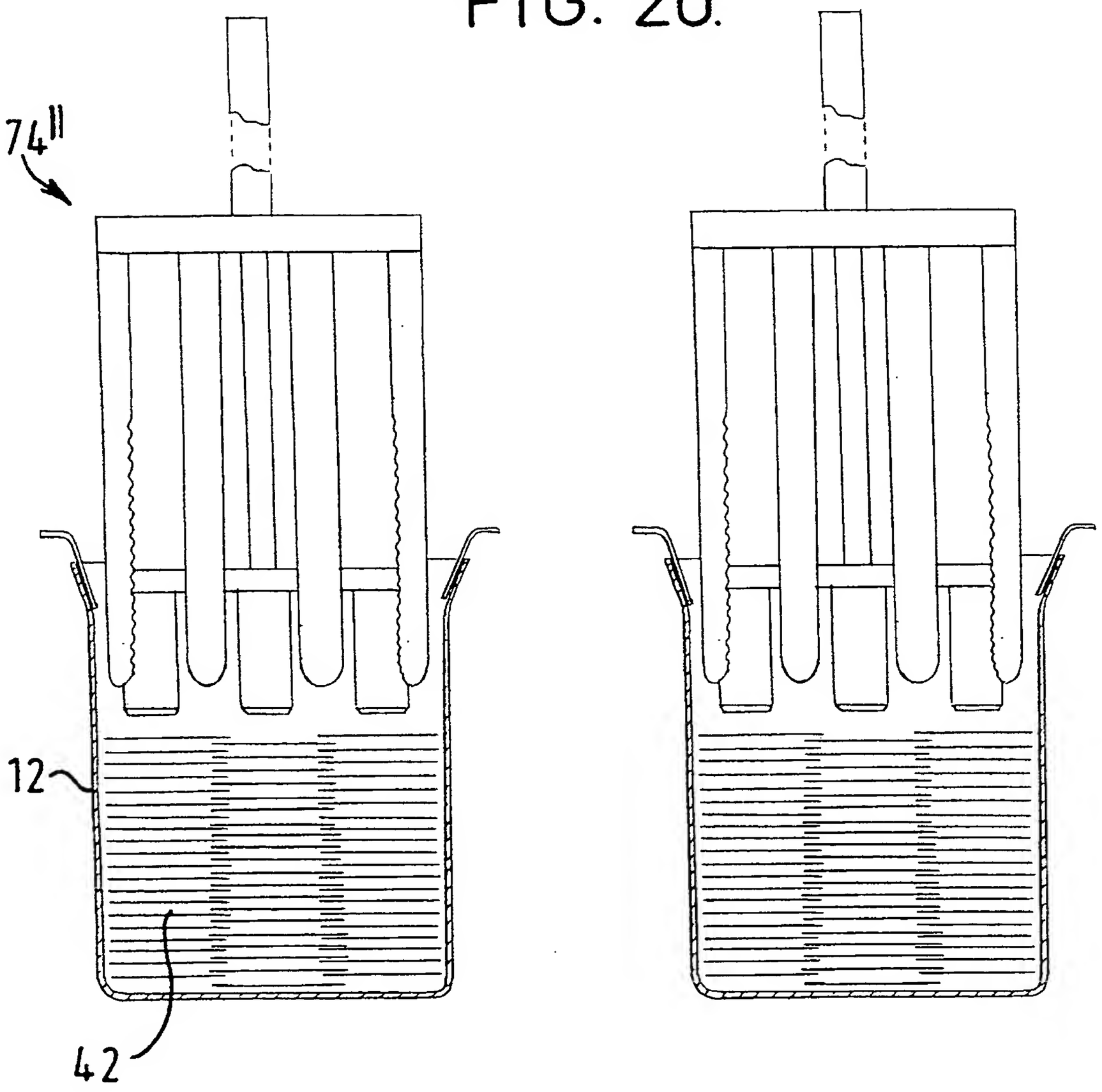
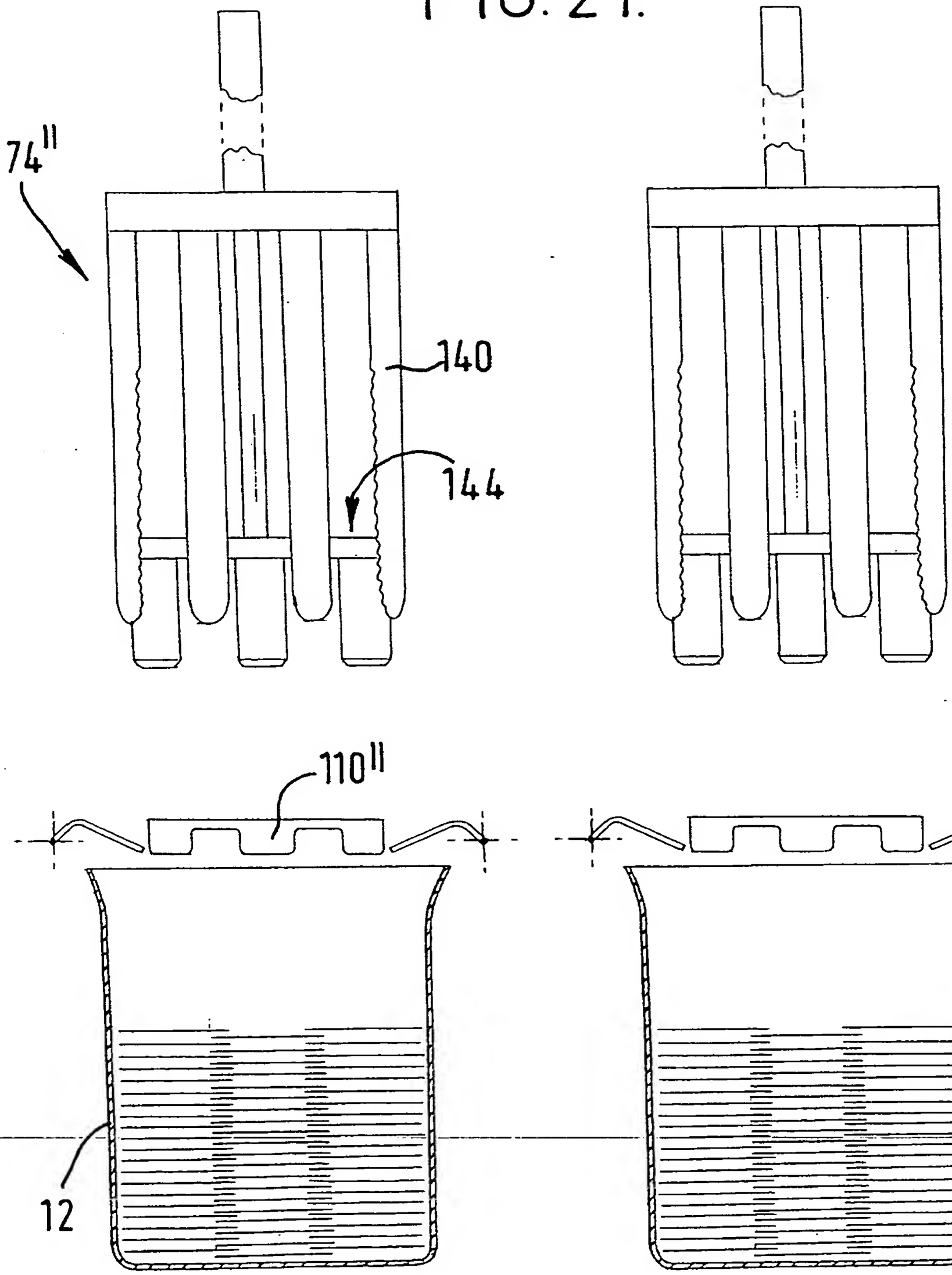


FIG. 21.



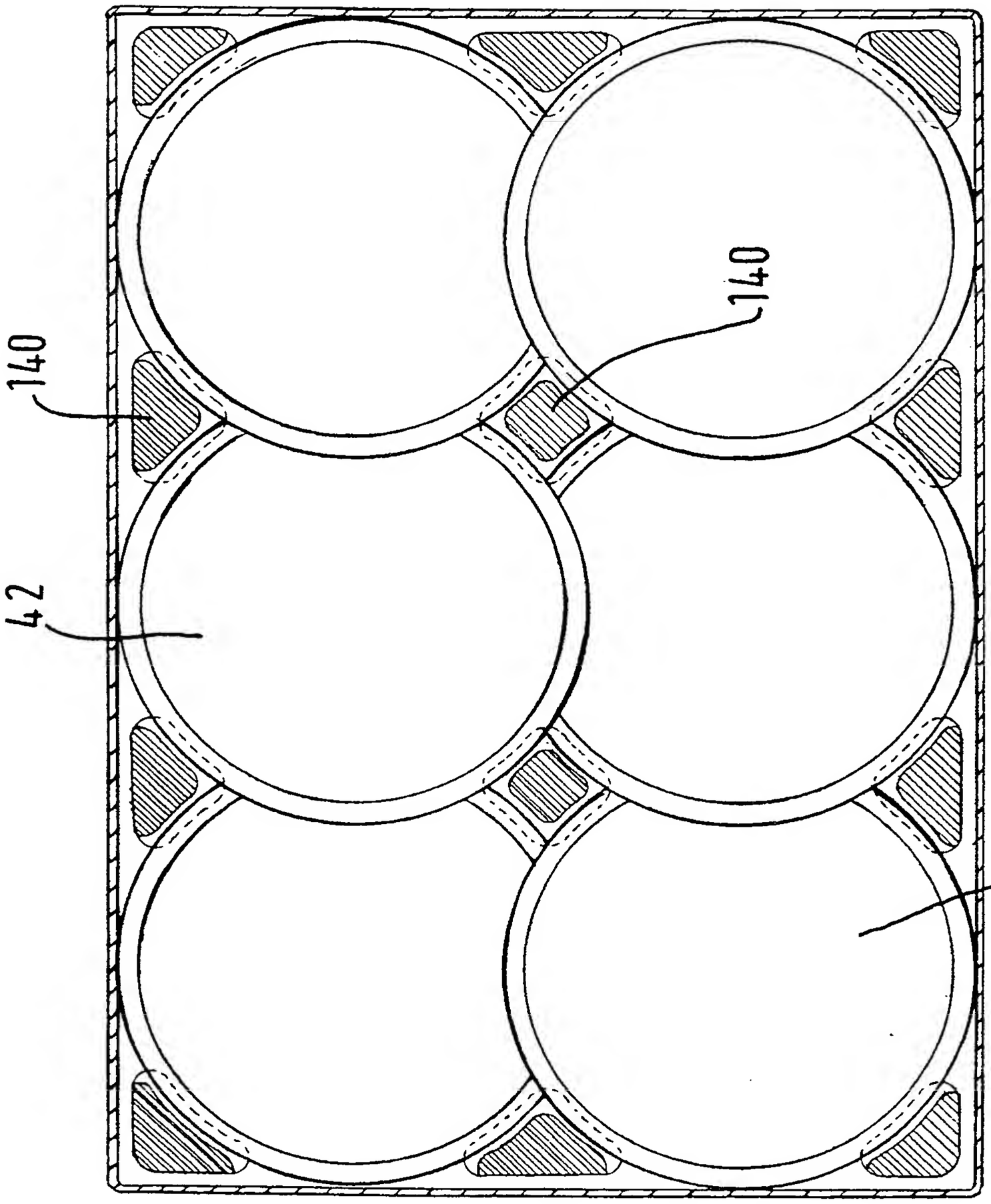
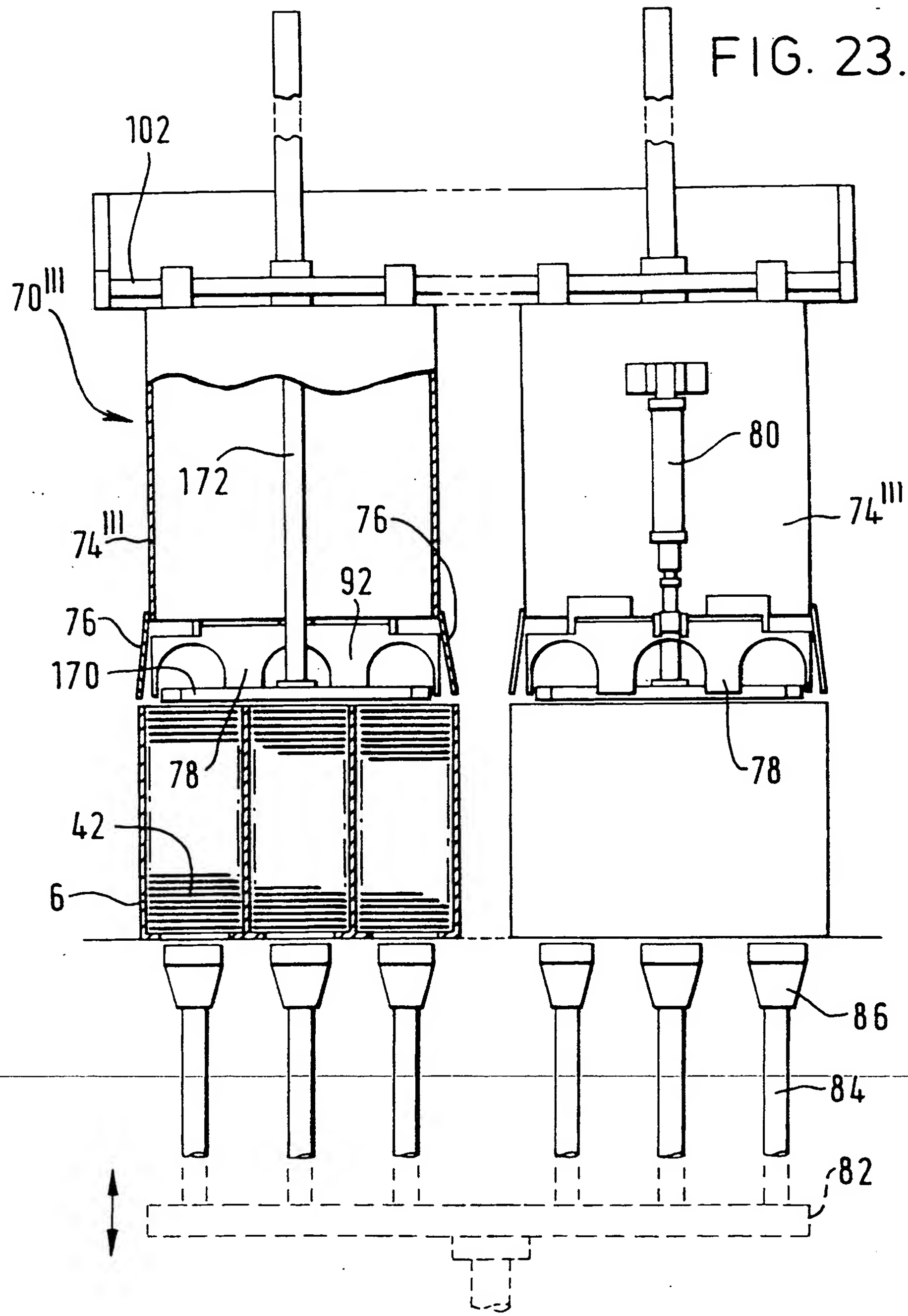


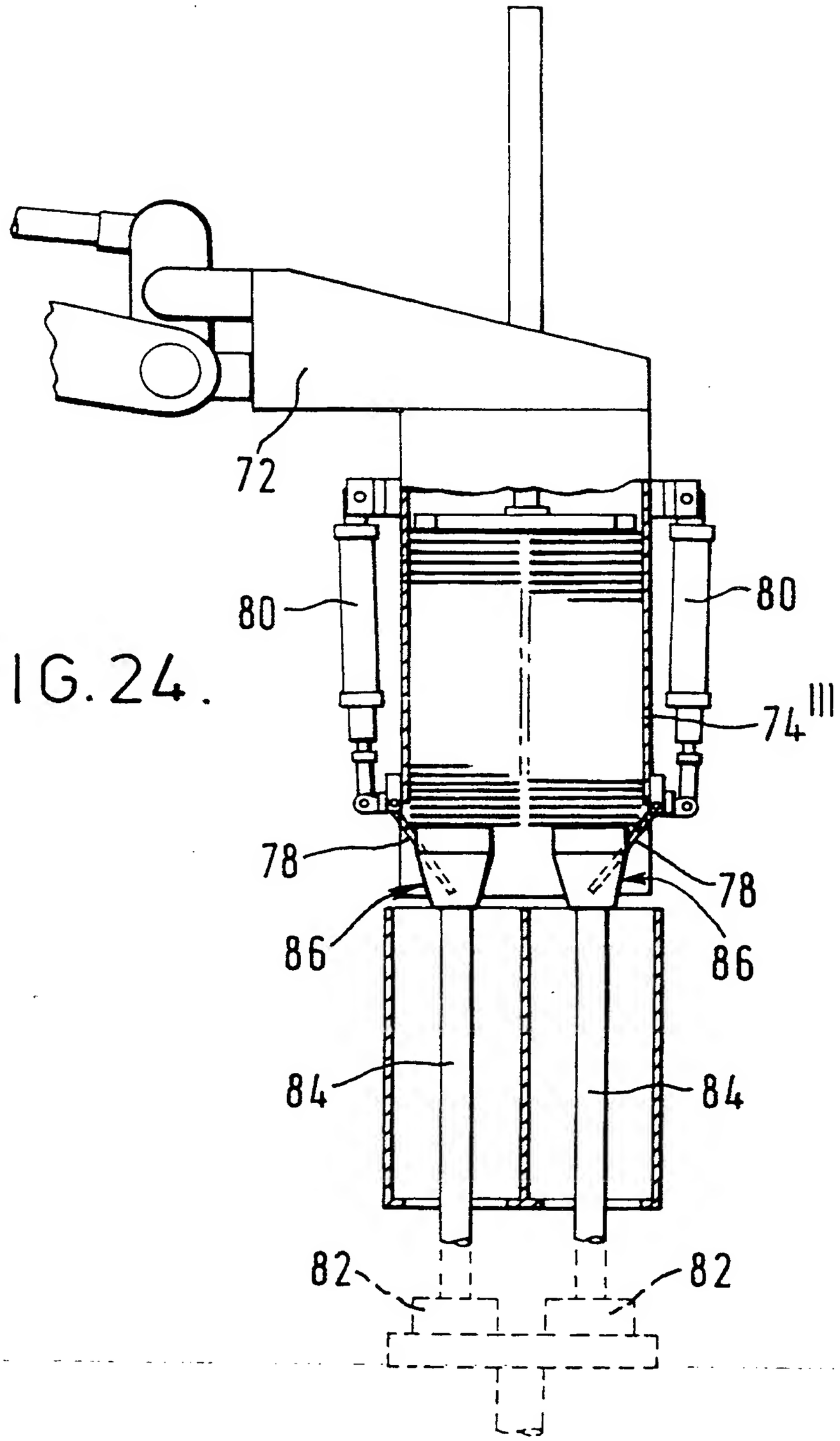
FIG. 22.

FIG. 23.



BNSDOCID: <WO 9937542A1_I_>

FIG.24.



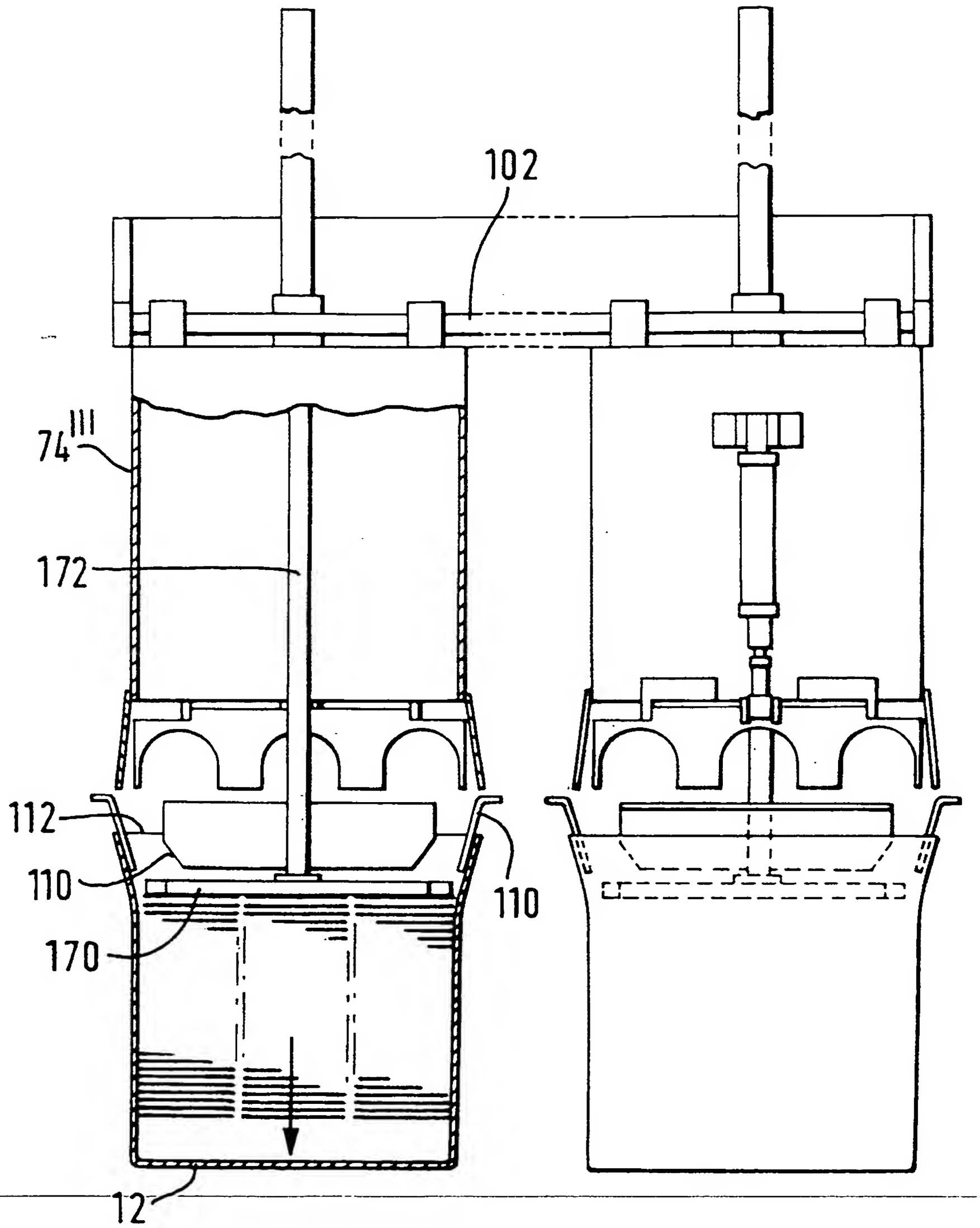


FIG. 25.

INTERNATIONAL SEARCH REPORT

Inter tional application No.
PCT/GB 99/00222

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: B65B 29/02
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B65B, B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, EPODOC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,Y	GB 2228912 A (PREMIER BRANDS U K LIMITED), 12 Sept 1990 (12.09.90), page 5, line 30 - page 8, line 32 --	1-32
Y	GB 2279638 A (PREMIER BRANDS U K LIMITED), 11 January 1995 (11.01.95), page 2, line 20 - page 4, line 17, figure 1 --	1-32
A	EP 0806353 A1 (I.M.A. INDUSTRIA MACCHINE AUTOMATICHE S.P.A.), 12 November 1997 (12.11.97) --	1-32
A	US 5689936 A (KENNEY), 25 November 1997 (25.11.97) --	1-32

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
27 April 1999	03. 06. 99
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+ 31-70) 340-3016	Authorized officer Inger Löfgren

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INTERNATIONAL SEARCH REPORT

In ational application No.
PCT/GB 99/00222

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

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07/04/99

International application No.
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